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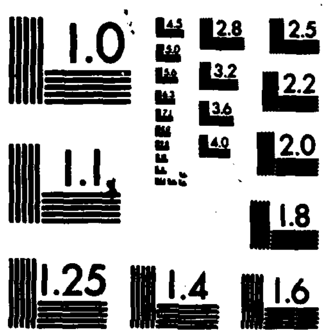

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HANDBOOK FOR UCSD
SC9 SCATHA
AURORAL PARTICLES EXPERIMENT

UNIVERSITY OF CALIFORNIA
SAN DIEGO

La Jolla, California

Center for Astrophysics and Space Sciences

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(1)

HANDBOOK FOR UCSD
SC9 SCATHA
AURORAL PARTICLES EXPERIMENT

University of California at San Diego
La Jolla, California

Center for Astrophysics and Space Sciences
Space Physics Laboratory

Under

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HANDBOOK FOR UCSD SC9 SCATHA
AURORAL PARTICLES EXPERIMENT

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1.0 INTRODUCTION

1.1 OBJECTIVES

The primary objective of this handbook is to provide a convenient source of information for the UCSD SC9 Auroral Particles Experiment. The expected end users of this document are scientists, programmers, and operators.

1.2 ACKNOWLEDGEMENTS

The UCSD/SC9 Auroral Particles Experiment was developed with funds provided by the National Aeronautics and Space Administration under Goddard Space Flight Center Contract Number NAS 5-21055 , Office of Naval Research Contract Number N00014-76-C-0432 and Air Force Contract Number F4701-77-C-0062.

1.3 SCOPE

The scope of this handbook is all of the scientific information related to the operation of the UCSD/SCATHA SC9 Auroral Particles Experiment

2.0 SUMMARY

2.1 SCIENTIFIC OBJECTIVES

The ~~general~~ objective ~~of the experiment~~ is the determination of magnetospheric processes in containing and accelerating charged particles near the earth. Of particular interest are those particles which are deposited into the upper atmosphere to produce aurorae. Geosynchronous orbits are well suited for these measurements as they are, much of the time, situated equatorially on magnetic field lines which connect with the earth in the auroral latitudes. Hence comparison with simultaneous ground base observations will be important.

Two pairs of ion and electron detectors are scanned orthogonally to make determinations of pitch angle distributions and to investigate plasma instabilities and wave-particle interactions. The magnetosphere constitutes a plasma of low density unobtainable in the laboratory.

Measurements made by experiments on ATS satellites in the past indicate also that near the midnight sector considerable changes in particle fluxes occur which coincide with geomagnetic substorm observations on the ground. Substorm Morphology is a subject of continuing interest and it is felt that the SC9 experiment can contribute a great deal to an understanding of it.

The modes of penetration of solar wind particles into the magnetosphere and their flow properties will also be studied. Times of enhanced solar activity will be of great interest.

SPACECRAFT CHARGING

The work done in analyzing data from the UCSD detector on ATS-5 (launched into geosynchronous orbit in August 1969) showed conclusively that a spacecraft at synchronous orbit can develop electrostatic charges of thousands of volts both between the spacecraft and the ambient plasma, and between parts of the spacecraft itself. Since then several types of synchronous orbitors have experienced anomolous effects in operation which have been traced to charging. These effects include spurious commands, degradation of amplifiers and solar cells, and in at least one case, complete loss of an Air Force Satellite. Some of the programs so affected are ATS, 777, INTELSAT, and COMSAT.

Unfortunately most of the affected spacecraft carry no plasma diagnostic equipment. Therefore analyses of

suspected charging effects were conducted by comparing times of occurence with ground-based geomagnetic observations and other satellite measurements (notably ATS-5). It is not surprising that no general one-to-one correspondences have been found between spacecraft anomalies and geomagnetic activity even though the envirenment-spacecraft interaction is strongly indicated.

The launch of ATS-6 in the Summer of 1974 helped this situation by extending the range of analyzed energies downward from 50 ev (ATS-5) to less than 1 ev. This permits direct observation of the low-energy secondaries and photo-electrons which have been theoretically shown to be important in charge balance. The additon of mechanically rotating detectors on ATS-6 has also permitted viewing fluxes narrowly collimated along the magnetic field line (this was impossible on ATS-5). Surprisingly, fluxes more than 100 times the flux perpendicular to the field have been seen regularly. Note that ATS-6 carries no electric field measuring devices, no magnetic search coils and no mass spectrometer.

As the effects of spacecraft charging have become known, investigation by several agencies realized that no good model existed to predict these effects, and that no spacecraft was planned to be flown at synchronous altitude with instrumentation necessary to provide enough information on which to build adequate models. Thus the Scatha program evolved.

COMMUNICATIONS

In addition to the important study of spacecraft charging, the instrument payload on SCATHA will be admirably suited to studying the naturally occurring and artificially stimulated wave particle interaction in the magnetosphere plasma at synchronous altitude under a wide variety of conditions of the local plasma. An improved understanding of the interaction between the electromagnetic waves and the particle constituents in the plasma is thought to extend our understanding of the origin of the particles and their injection, acceleration, transport, and loss processes and to assess the feasibility of modifying the natural plasma composition or the wave characteristics

1) for communication purposes,
2) to precipitate or enhance trapping of energetic particles in order to modify the lower ionosphere,
3) as a technique of further investigation of

geophysical processes.

In all of these objectives and goals for SCATHA, the UCSD Auroral Particles Detectors play a key role. While the true value of SCATHA is in its coordinated set of instruments, it would be no exageration to say that the UCSD SC9 Auroral Particles Experiment is the single most valuable.

2.2 GENERAL INFORMATION

Spacecraft - The P78-2 (SCATHA) spacecraft is a spinning satellite that will be placed in a near synchronous, near equatorial earth orbit from the Eastern Test Range by a Delta 2914 in January 1979. The satellite houses, protects and supports thirteen scientific and engineering experiments. It spins about an axis in the orbit plane and normal to the sunline. The satellite is controlled by the Air Force Satellite Control Facility (AFSCF) and communicates directly with remote tracking stations in New Hampshire, the Indian Ocean, Guam, Hawaii and at Vandenberg AFB. The mission is planned for a one year duration and the Space Vehicle is provided with sufficient consummables for two years. Actual lifetime of the satellite will probably be limited by survival of electronic equipment in the ionizing radiation environment.

Satellite Configuration - the body of the satellite has a cylindrical shape approximately 1.75 meters in both length and diameter. On orbit seven experiment booms are deployed. The final configuration is shown in Figure 2.2-1. In addition to the booms antennna hardware and some instrument protrusions alter the basic cylindrical geometry.

Most of the Spacecraft and Payload equipment is mounted in the central, bellyband portion of the cylinder, instrument apertures, test surfaces, and experiment booms are located in this region. The boom arrangement isolates sensitive instruments from Space Vehicle influences and provides clear fields-of-view for experiments sensitive to low energy particles or contamination. The bellyband is covered with access panels coated to meet requirements of the experiments and the thermal control subsystem. Two solar arrays encircle the cylinder, one forward and one aft of the bellyband. The apogee insertion motor (AIM) is housed in a central tube. A tripod mounted on the central tube supports the forward communications antenna mast and a spider structure that in turn supports equipment located at the forward end.

Materials - Special lightweight materials are used in the spacecraft structure because the P78-2 orbit and payload are near the maximum capability of the Delta 2914 launch vehicle. The center tube is made of magnesium. The aft equipment deck is aluminum honeycomb. The forward deck is an aluminum beam structure. The solar array substrates are aluminum core honeycomb with a fiberglass outer face and an aluminum

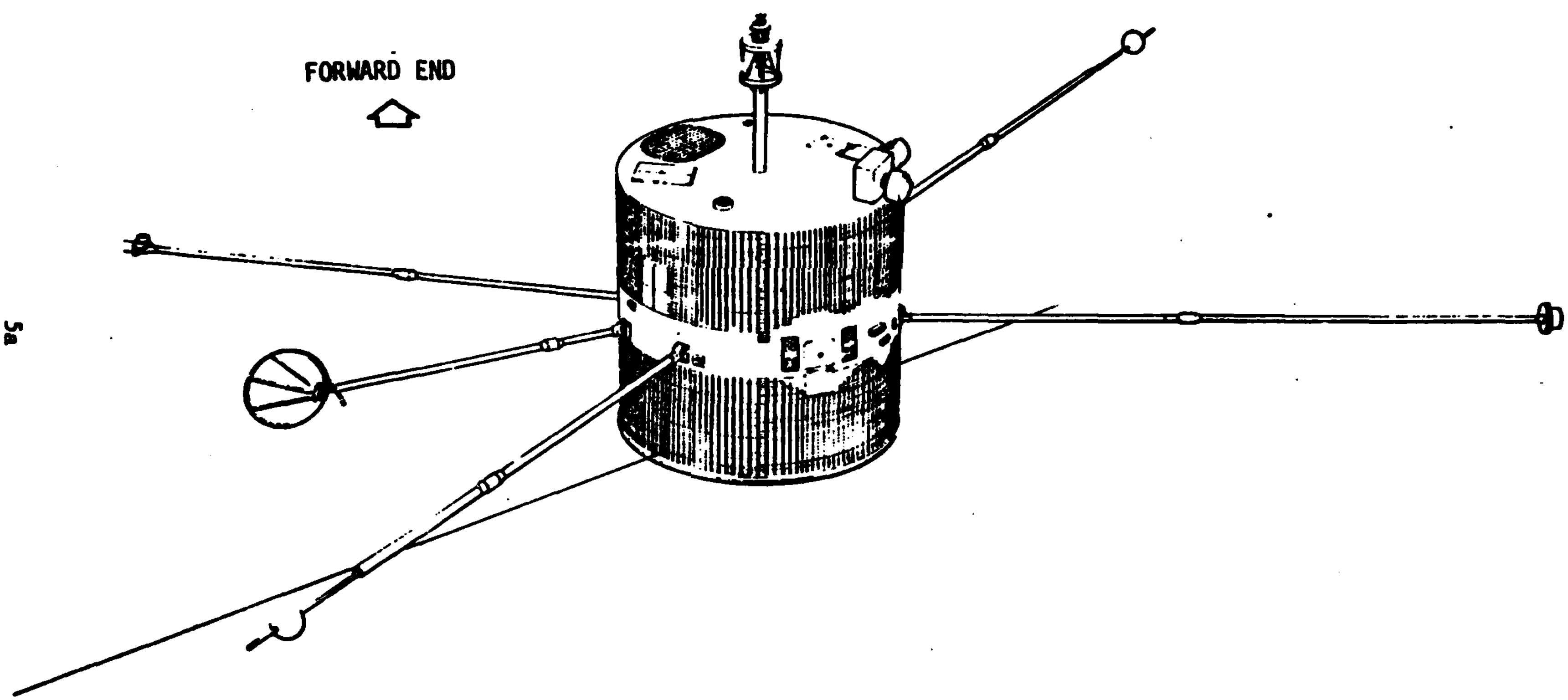


Figure 2.2-1
SCATHA SPACE VEHICLE

arrays is mostly reradiated to space since the emissivity of the outer surface of the arrays is much higher than that of the inner face. The bellyband access panels, covered with second surface mirrors and thermal control paints, run cool in the sun light and function as effective radiators of waste energy form the deck mounted equipment. Equipment at the ends of the spacecraft is kept warm by radiation from the deck mounted equipment. To make this approach effective rejection of heat by the end surfaces has been minimized. The thermal design contains special features to accommodate the following aspects of the mission and payloads.

1. The solar arrays are isolated from the equipment sections to prevent excessive radiative cooling during eclipse periods.

2. Some payloads and electric heaters are turned on in the transfer orbit to limit cooling of the spacecraft during this period.

3. A few components with low operating temperatures are isolated from spacecraft heat sources and radiatively coupled to the external environment.

4. Critical components such as batteries, the AIM and hydrazine rocket subsystem tanks, lines and valves are electrically heated.

5. The AIM is a large heat source during its burn and subsequently until is is jettisoned. The insulation which protects the satellite from this heat source also prevents significant heat rejection through the aft central cavity during the mission operations period.

6. The Rapid Scan Particle Detector (SC5) view cavity is pointed normally to the sunline. The walls of the cavity are radiatively isolated from the equipment compartments to prevent excessive heat loss through this cavity.

Electrical Power - 291 watts of power for spacecraft and payload functions are obtained from two solar arrays. The arrays are basically cylindrical with some irregularities in configuration to provide special surfaces surrounding instrument apertures and test samples. The projected area of each array is approximately 15 square feet averaged over a complete satellite spin rotation. The spacecraft and experiment electrical loads are supplied by the array except when those loads exceed the array capability. At such times

three Nickel Cadmium batteries supply the additional power. In particular, the batteries supply the entire load during boost phase and eclipse operation. When the array capability exceeds the loads the batteries are charged. Any excess power is dissipated in resistive radiatiors.

The high sensitivity spectrum analyzers in payload SC1 can be commanded to operate from a separate battery if required to do so to achieve suitable isolation from electromagnetic interference.

Data System - The basic data rate from spacecraft and payloads is 8192 bits per second. This data can be transmitted in real time or tape recorded for later transmission. Data transmission in the tape playback mode takes place at 65536 bits per second. Each of the two tape recorders has a 12 hour capacity. The normal procedure is to record on one tape recorder until it is full. The other recorder, previously filled, is played back during periodic ground contacts.

In addition to the 8192 bps data stream there is a 512 bps channel and a broadband channel. The 512 bps channel contains critical spacecraft and payload information that also appears in the 8192 bps data. The 512 bps and 8192 bps channels are not used simultaneously. The broadband channel provides frequency response up to 5 KHZ and can be used in a number of different modes to handle analog data from one or more experiments.

At any time the use of a particular data mode depends on the capability of a tracking station to close the appropriate telemetry link and the availability of that station to support the mission. The spacecraft has the capability at all times in the final orbit to close some telemetry link with the system of ground stations.

Data Transmission - Real time or recorded data are transmitted to the AFSCF ground stations by an S-Band downlink. Either of two redundant transmitters may be used with any of three antennas in this link. The transmitter output is 10.5 watts. The carrier is modulated with a 1.024 MHZ PSK (phase shift keyed) subcarrier. The 1.024 MHZ subcarrier can be used alone or summed with either a 1.7 MHZ PSK subcarrier or a 1.7 MHZ FM subcarrier.

Omni antennas, mounted at both ends of the spacecraft, provide full spherical coverage. Each of these antennas consists of crossed flat dipoles over a truncated, slotted cone. The dipoles are fed in quadrature. The third antenna is a radial array mounted on the same mast

as the forward omni. This antenna consists of two crossed dipoles over truncated, slotted cones, placed back-to-back. These dipoles are fed in parallel and in phase to radiate a toroidal pattern coaxial with the vehicle spin axis. Annular ring resonant cavity chokes are used to narrow the beam from this antenna. The radial array is used for data transmissin only, while the omnis are used for command reception as well.

Command and Timing - The command system is fully redundant. Two omni antennas, one at each end of the spacecraft, feed either of two strings of receiver-demodulator, decoder and command distribution units. The system accepts commands from the AFSCF-SGLS (Space-Ground Link Subsystem). The maximum command rate is one per second. Latching and momentary, high current (relay driver) and low current (logic level), contact closure and serial digital commands are provided to payloads and spacecraft subsystems. Timing

signals ranging in frequency from 2^{-8} Hz to 2^{18} Hz are distributed. These signals are generated from a basic oscillator output that is initially accurate to plus or minus 1 ppm and drifts less than 0.01 ppm/day.

Attitude Control and Determination - Spacecraft attitude is determined from the outputs of four digital sun sensors and two steerable horizon crossing indicators. These data are processed on the ground and control actions are directed by uplink command. Two rocket engine modules provide thrust for precessing the spin axis, controlling the spin rate and imparting velocity increments for orbit adjustment. Each module consists of one 6.67 pound thrust and three 0.238 pound thrust hydrazine rocket engines. Two oil filled nutation dampers provide angle damping. In the final spacecraft configuration, with all booms deployed and the satellite spinning at one RPM, the damping time constant is 8 hours.

The Orbit - The satellite is placed in a 100 by 23100 nautical mile transfer orbit by the Delta 2914 launch vehicle. This orbit is inclined 28.77 degrees to the equatorial plane. At apogee on the fourth revolution the satellite performs a combined maneuver raising perigee altitude to 15038 nautical miles and reducing the inclination to 8.3 degrees. The final orbit is adjusted to provide a slow easterly drift of the satellite ground track, typically 6 degrees per day, (Figure 2.2-2).

The spatial relationships between the Earth, its magnetosphere and the satellite orbit are shown qualitatively in Figure 2.2-3. On March 20, the fifty-fifth day of the mission, the satellite orbit

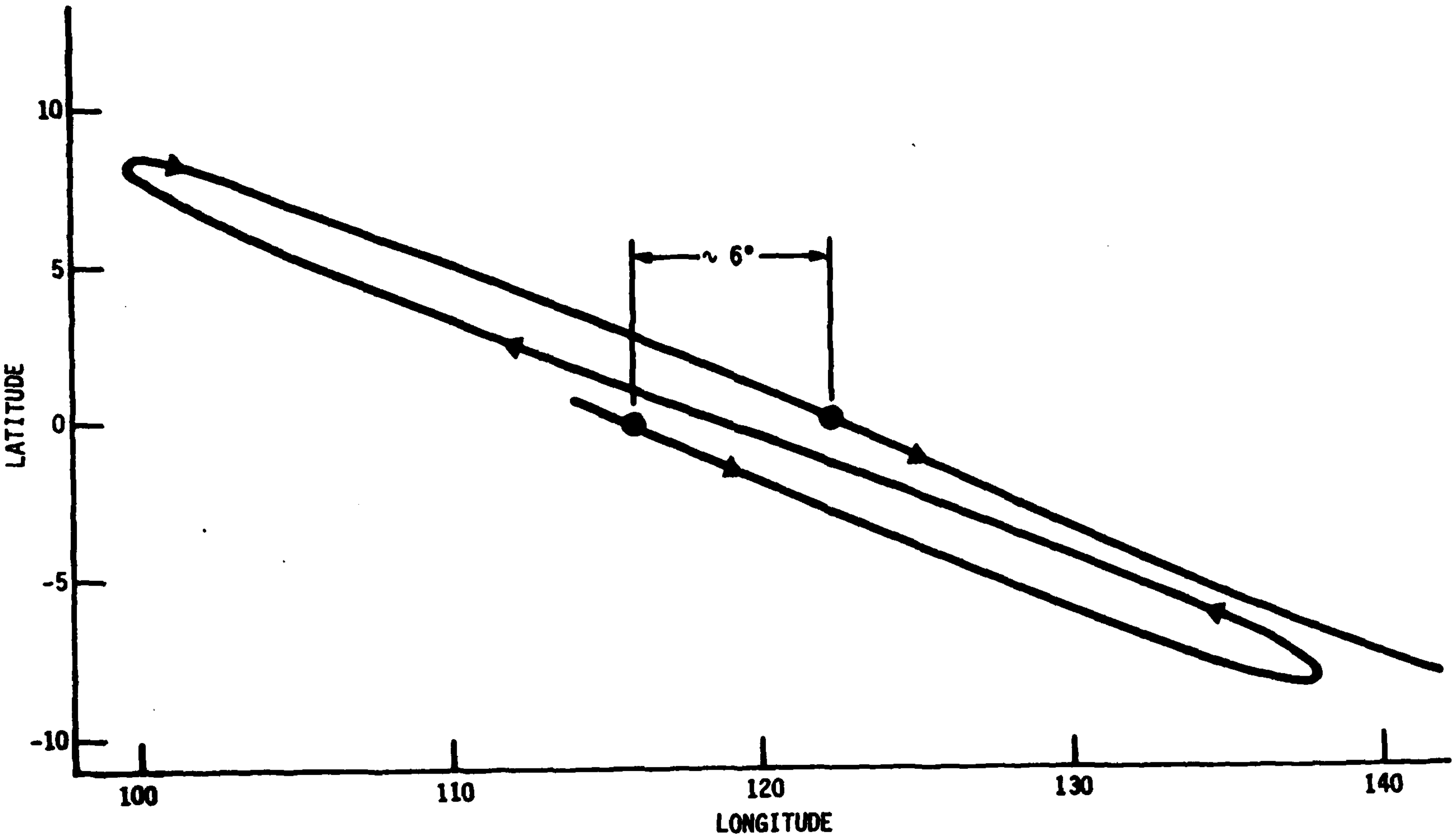


Figure 2.2-2

TYPICAL GROUND TRACK DURING FINAL ORBIT

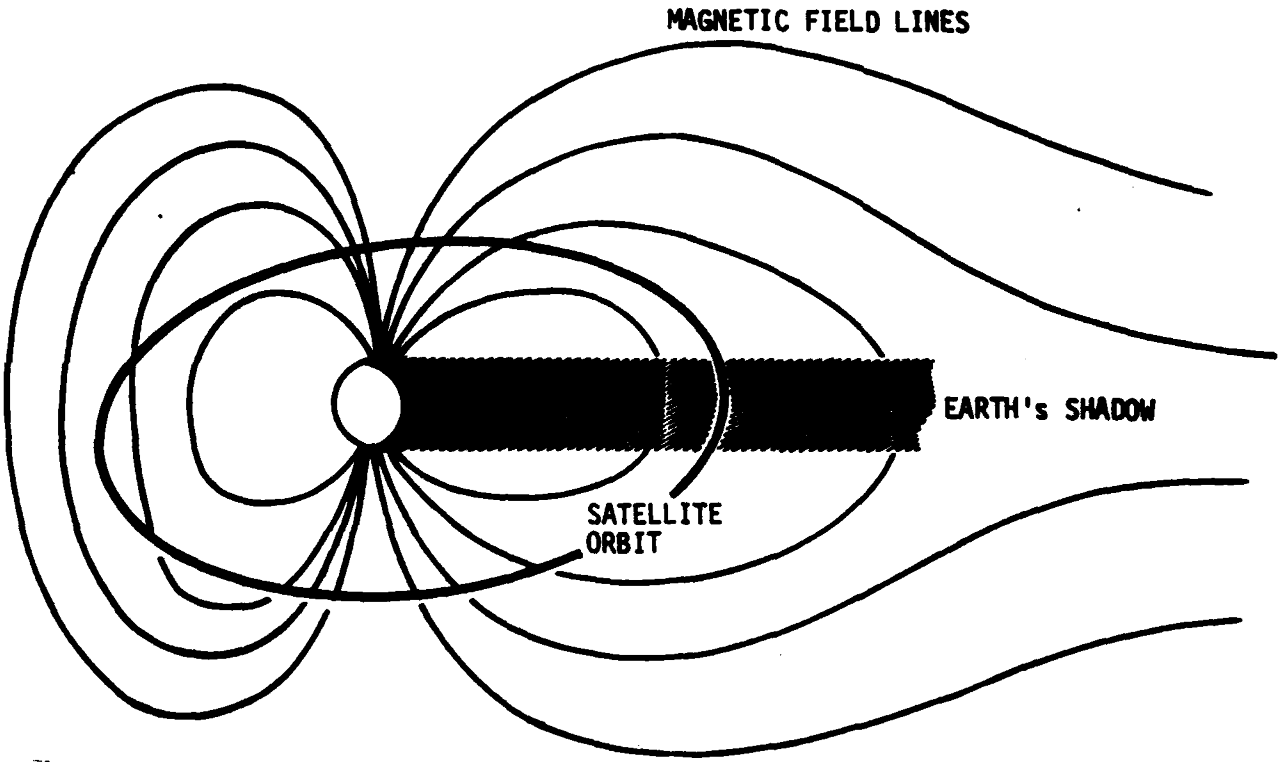


Figure 2.2-3
P78-2 ORBIT AND THE MAGNETOSPHERE

begins to intersect the Earth's shadow (Figure 2.2-4). This spring eclipse season lasts forty-four days with a maximum eclipse duration of seventy-one minutes. A second eclipse season is encountered in the fall.
NOTE: See *Appendices for list of eclipse times.*
Operations - Science activity on P78-2 is usually limited by ground data handling capacity. In principle the satellite could support 24 hours each day of narrow band activity and up to ten-hours of broadband activity. The total tape recorder capacity is 24 hours of data so to support full time activity the tape recorders would need to be completely played back once a day. The AFSCF controls many other satellites so it may not always be able to provide P78-2 with the contact time desired to playback the recorders and support the broadband activity too. When contact time is available experiment operation is limited by spacecraft data handling capabilities. An exception to this occurs on the days of the longest eclipses. At those times broadband data transmission and operation of the electron and ion guns is restricted to avoid exceeding an 80% discharge of the batteries.

The mission sequence (see Figure 2.2-5), following orbit insertion and ejection of the insertion motor, calls for adjustment of the orbit to achieve a slow eastward drift of the ground track. The satellite spin axis is then oriented normal to the sunline. This orientation is essential to satisfactory operation of the scientific payload as well as operation of the spacecraft power subsystem. The spin axis is precessed throughout the mission at approximately one week intervals to maintain normality to the sunline. Once the satellite is properly oriented booms are deployed for the thermal electron (SC6), the spacecraft sheath fields (SC2), the magnetic field (SC11) and the RF fields (SC1) experiments. The payloads are checked out individually and in combination during the next few days and then begin normal operation. Exceptions are the electron and ion guns (SC4) and the electric fields (SC10) experiment.

The inherent danger of electron and ion gun operation for the electron multiplier type of detectors used in many of the payloads requires special operational precautions. For this reason initial gun operations do not start for at least three weeks. The first eclipse season may begin before the guns are fully checked out. Whether or not checkout is complete, gun operation will be suspended for ten days beginning shortly before the first eclipse. Checkout of the guns will be completed, if is has not previously been finished, during the remainder of the eclipse season. The two 50 meter antennnas deployed for the electric field experiment

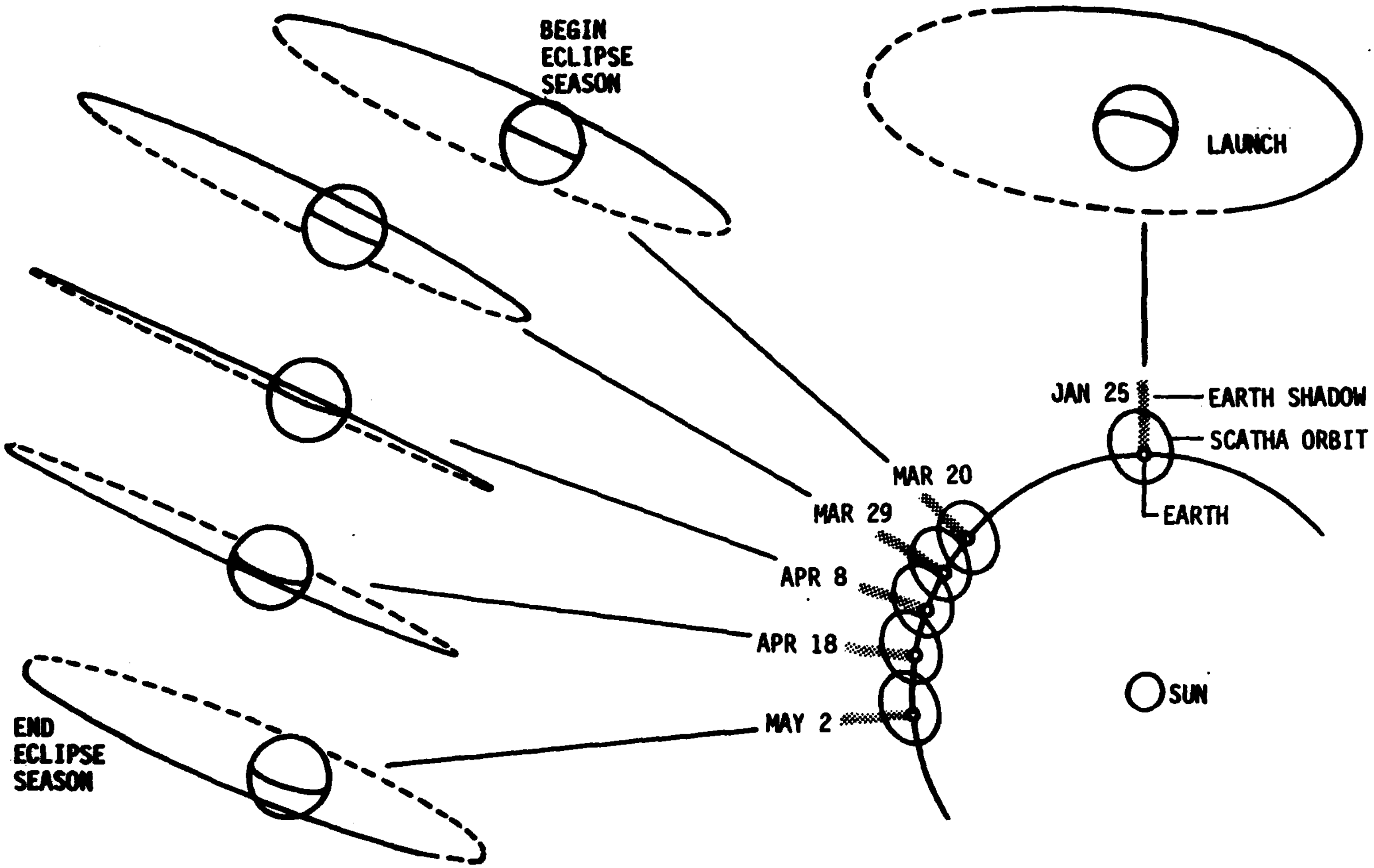
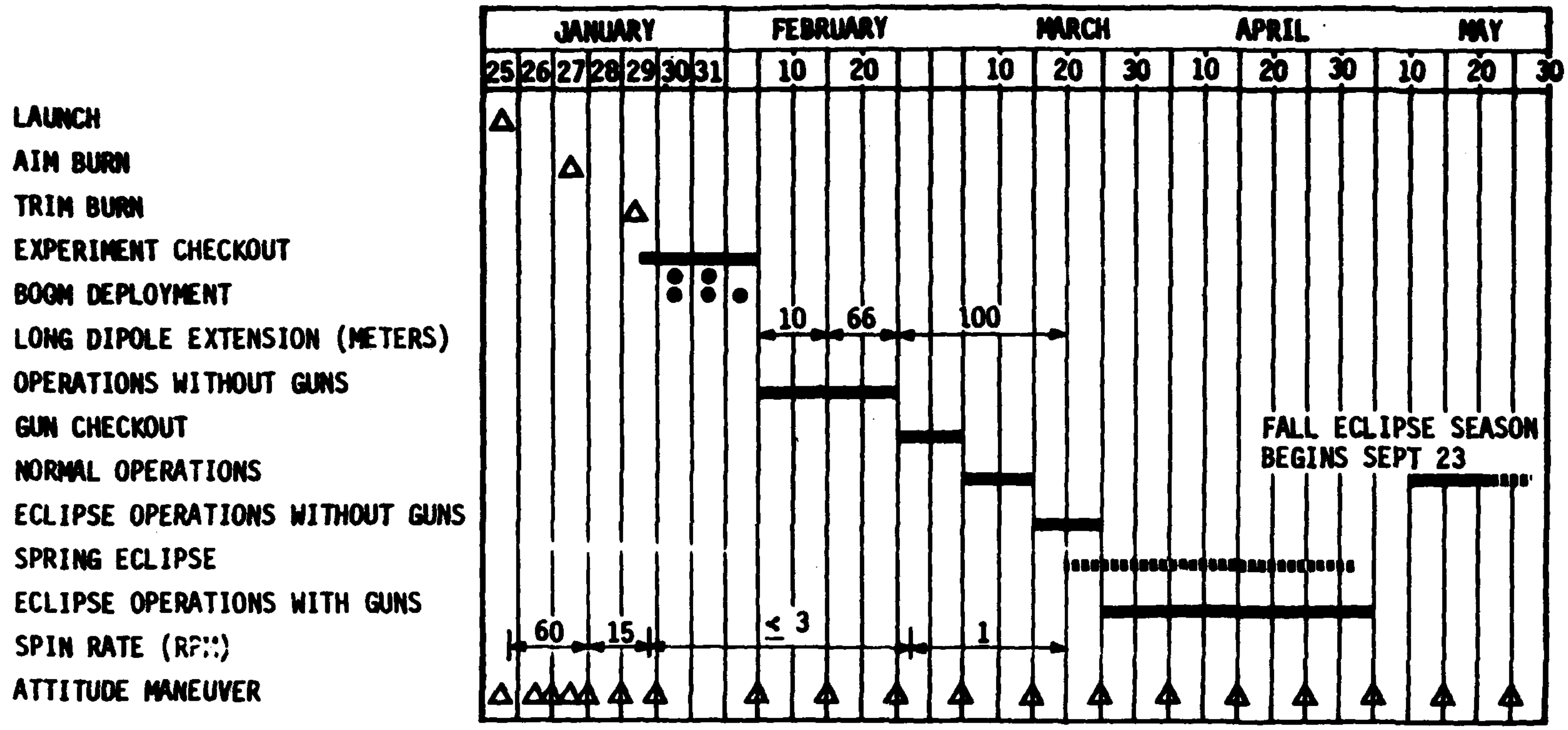


Figure 2.2-4

SCATHA ORBIT AND EARTH VIEWED FROM SUN



	TRANSFER ORBIT	FINAL ORBIT
APOGEE	23100 n mi	23100 n mi
PERIGEE	100 n mi	15038 n mi
INCLINATION	27.4°	8.3°
PERIOD	12.86 hr	23.54 hr
DRIFT RATE	--	6° DAY EASTWARD

KEY PARAMETERS

Figure 2.2-5 MISSION OPERATIONS THROUGH SPRING ECLIPSE SEASON

will significantly change the electrical configuration of the satellite. To permit baseline data to be taken by experiments sensitive to the satellite electrical configuration and to allow complete observation of effects on spacecraft dynamics, the long antennas will be deployed in steps over a period of weeks beginning 11 days into the mission. At the end of the eclipse season, ninety days into the mission, the P78-2 satellite and its varied and interactive payload begin what can be called normal operations.

TABLE 2.2-1

SUMMARY OF SPACECRAFT OPERATIONS

DAY	SC-9 EVENTS	IMPT. SPACECRAFT EVENTS
30	check-out; scan mode	LAUNCH 1:42 pst
31	check-out;scan mode	
32	check-out; limited data	
33	limited data; FM mode	Aim burn (18:00); ATT change
34	limited data	
35	limited data	
36	limited data	Aim Separation
37	limited data	
38	limited data	FINAL ORBIT
39	Bias Test; check-out	SC-2 Boom deploy
40	Data really begins; FM mode	
41	check-out;FM mode	SC-6 failure
42	FM mode	Initial Gun Operation
43	on	
44	on	Gun On
45	on	Gun On
46	on	Gun On
47	on	Gun on; ATT maneuver (?) Induced Charging Event(ICE)
48	on	Transmitter trouble; XMTR1-Degraded; XMTR2 Turned ON
49	on	SC-7 failure
50	on	EMI Test
51	on	Prestorm; SC-7 failure

Table 2.2-1 cont.

52	on	Spin up; Storm MP crossing; Trans. 1 diagnostics
53	on	Magnetosheath encounter; SC-11 On; SC1-4 boom deploy
54	on	Still storm
55	on	SC-6 boom deployment
56	limited data	SC10 boom extension(10 m); T-R dumps off; 20 min passes; ATT man
57	on	20 min passes
58	on	20 min passes; SC10,SC11 data
59	on	20 min passes
60	on	
61	on	XMTR-1 check-out
62-67	limited data	
68	limited data	SC10 full boom extension
69-72	limited data	
73	limited data	Precession maneuver
74	limited data	
75	limited data	Enter ECLIPSE PERIOD (penumbral)
76	on	Enter umbral eclipse period; precession maneuver
81	on, off during ATT maneuver	EDG EVENT ATT Maneuver (22:00, zulu time)
87	on	LUNAR ECLIPSE (8:00-12:00 zulu time); EDG EVENT
88	on	EDG EVENT
89	on	GUN ON; SC-2 malfunction;EDG EVENT
90	on	GUN ON
91	on	GUN ON
92	on	GUN ON; EDG EVENT

Table 2.2-1 cont.

93	on	GUN ON; EDG EVENT
94	on	GUN ON; ICE EVENT; EDG EVENT (entire day)
95	on; BIAS TEST	GUN ON; ICE; EDG EVENT
110	on	ICE
111	on	GUN ON
112	on	GUN ON
113	on	GUN ON
114	on	ICE; EDG EVENT
115	on; BIAS TEST	GUN ON
116	on	GUN ON
119	on	END ECLIPSE PERIOD (umbral)
120	on	END ECLIPSE PERIOD (penumbral)
124	on	SEE check-out
125	on, off during ATT maneuver	Attitude maneuver (02:00)
132	on, off during ATT maneuver	ATT maneuver (01:00)
139	on, off during ATT maneuver	ATT maneuver (05:00)
143-145	on	Geos 2 conjunction period
146	on, off during ATT maneuver	Geos 2 conjunction period; ATT maneuver (04:00)
147-151	on	Geos 2 conjunction period
152	on; cnt not there;	Geos 2 conjunction period; GUN ON
153	on; cnt not there; off during ATT man.	Geos 2 conjunction period; GUN ON ATT maneuver (03:00)
154	on; cnt not there	Geos 2 conjunction period;
155	on; cnt not there	Geos 2 conjunction period;

Table 2.2-1 cont.

163	on, off during ATT maneuver	ATT maneuver (03:00)
173	on, off during ATT maneuver	ATT maneuver (21:00)
179	on; BIAS TEST	
184	on, off during ATT maneuver	ATT maneuver (15:00-18:30)
194	on, off during ATT maneuver	ATT maneuver (17:30-18:30)
200	on	GUN ON; EDG EVENT
201	on; BIAS TEST	GUN ON; EDG EVENT
202	on	GUN ON
208	on, off during most of ATT maneuver	ATT maneuver (22:00-24:00)
218	on, off during ATT maneuver	ATT maneuver (22:00)
228	on, off during ATT maneuver	ATT maneuver (13:00)
238	on, off during ATT maneuver	ATT maneuver (11:00-12:00)
248	on, off during ATT maneuver	ATT maneuver (14:00-18:00)
251	on	SC1-7 EMI Test
263	on	BEGIN ECLIPSE PERIOD (penumbral)
264	on	BEGIN ECLIPSE PERIOD (umbral)
268-273	eclipse ops. once a day	
275	on	GUN ON
278	on; BIAS TEST	
285	on	GUN ON
293	on	GUN ON
295	on	GUN ON

Table 2.2-1 cont.

297	on	GUN ON
298	on	GUN ON
306	on, off during ATT maneuver	END ECLIPSE PERIOD (UMBRAL); ATT maneuver (12:00-14:00)
308	on	END ECLIPSE PERIOD (penumbral)
316	on, off during ATT maneuver	ATT maneuver (12:30-14:00)
326	on, off during ATT maneuver	ATT maneuver (14:00-16:00)
331	on, off during ATT maneuver	ATT maneuver (20:00-22:00)

2.3 EXPERIMENT DESCRIPTION

2.3.1 General Configuration

The UCSD/SCATHA SC9 Auroral Particles Experiment illustrated in Figure 2.3-1 has a compliment of five detectors. Two detectors, one detector of negatively charged particles and one detector of positively charged particles, are contained in each Rotating Detector Assembly (RDA). Each Rotating Detector Assembly is attached to the main housing by a shaft driven through worm gears by a stepper motor. An RDA can be rotated through some 220 degrees, thus enabling one to make measurements of the flux of charged particles at different angles. The two RDA'S rotate in planes which are orthoganal. An additional detector of positively charged particles is mounted in the main housing and is called the Fixed Detector Assembly (FDA).

Figure 2.3-2 illustrates the detector geometry while Figure 2.3-3 illustrates the nominal field of view of each detector. The UCSD/SCATHA SC9 Auroral Particles Experiment is mounted to the SCATHA Spacecraft as shown in Figure 2.3-4. Details of spaceraft orientation and mounting geometry can be found in Section 2.2.

2.3.2 Charged Particle Detectors

Each Detector is made from three subassemblies:

1) an electrostatic curved plate energy/unit charge analyzer
2) an electrostatic grid structure which acts as a lens to focus those particles that have passed through the energy analyzer upon the sensor
3) a Bendix model 4213-PAC/WL spiraltron particle sensor with appropritate pulse electronics which counts the analyzed particles.

The Electrostatic Analyzer

The plates of the energy analyzer are driven by a power supply that can be programmed to supply any one of 64 voltage steps. In the SCATHA configuration, one of the RDA'S is a high energy detector while other RDA and the Fixed Detector Assembly are low energy detectors.
For the high energy detector, the energy range coverd by the 64 voltage steps is approximately 1 to 80,000 e.v. and for the low energy detector's the energy range is approximately 1 to 2,000 e.v.

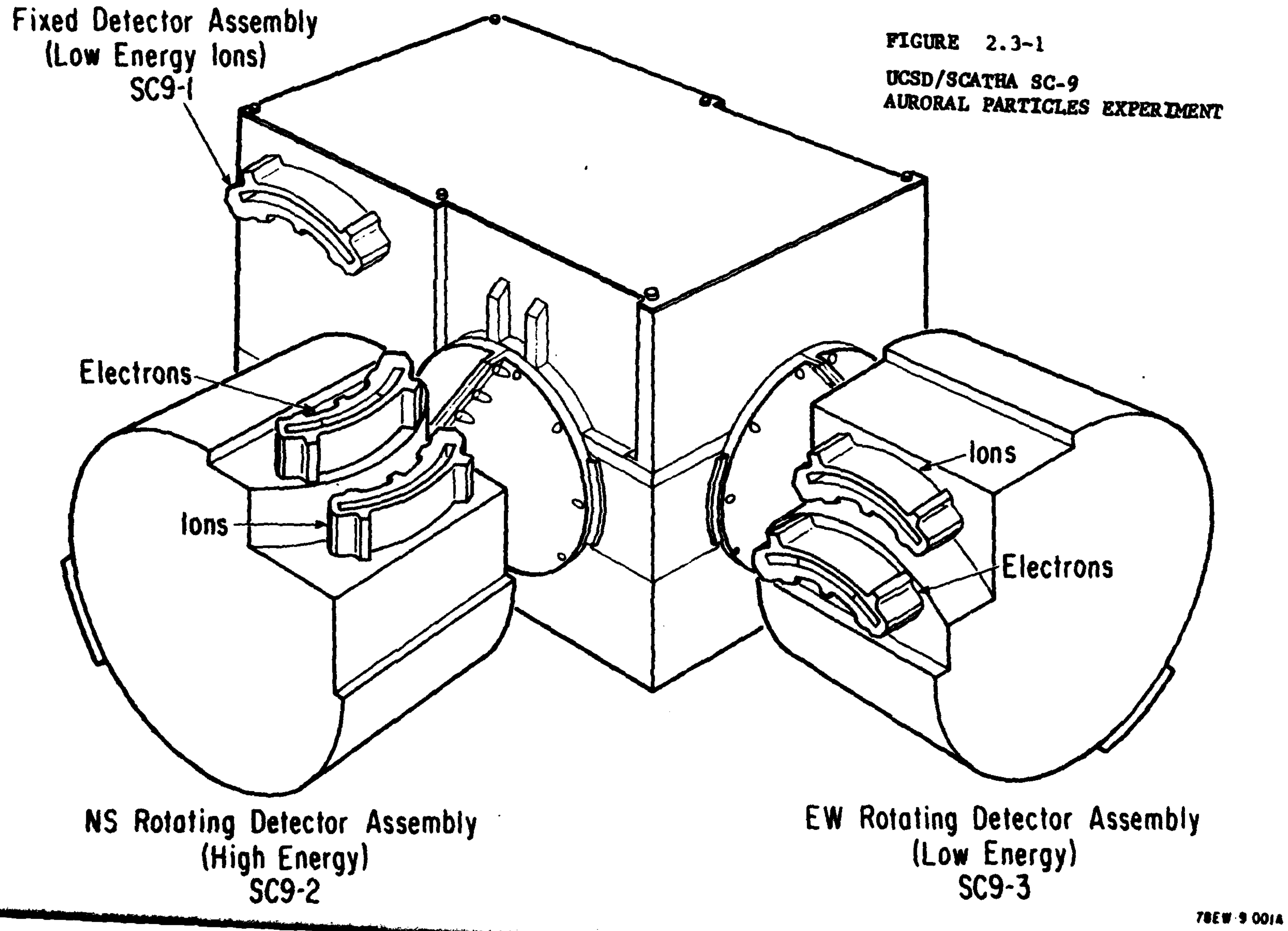
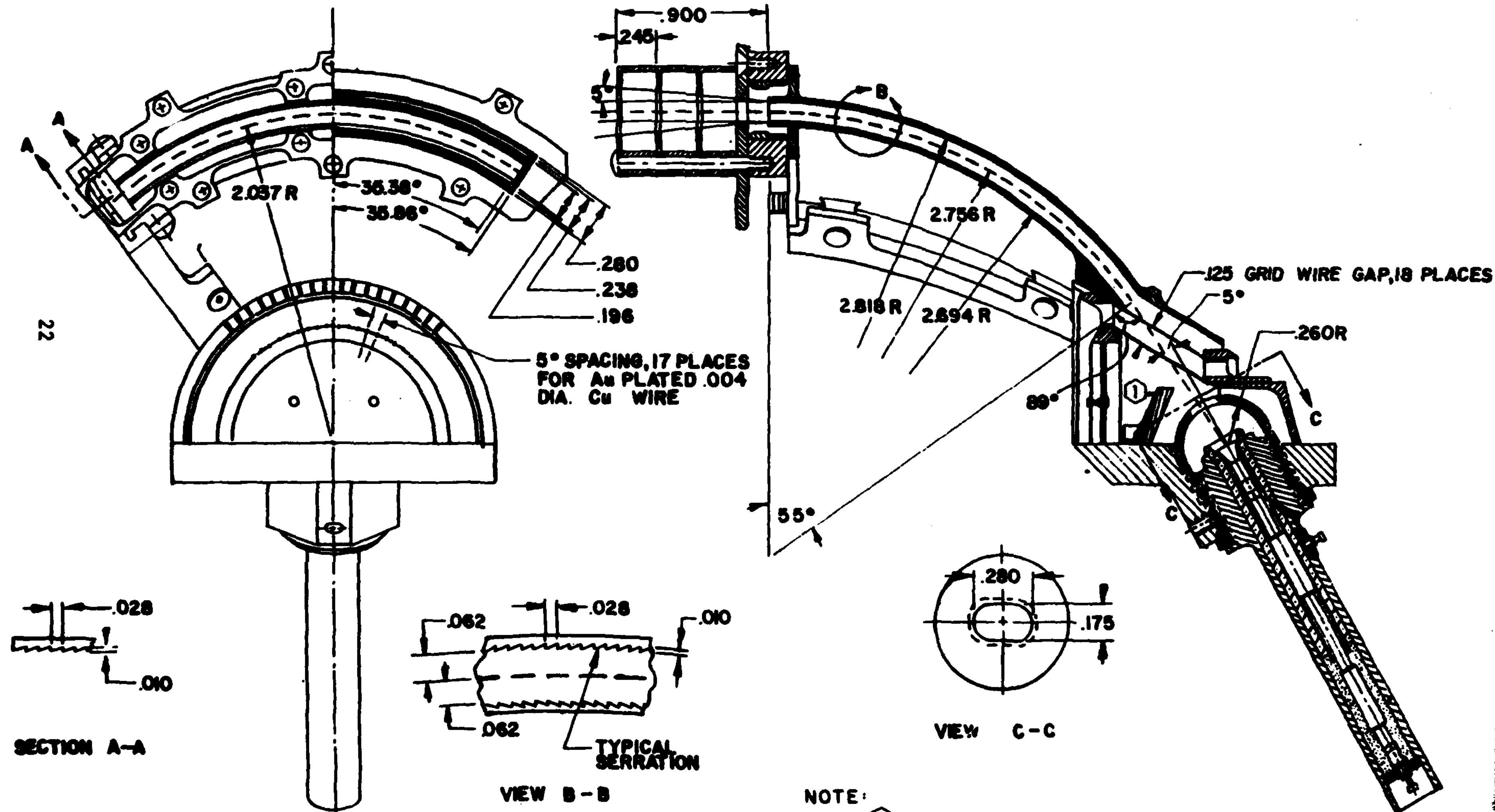


FIGURE 2.3-1

UCSD/SCATHA SC-9
AURORAL PARTICLES EXPERIMENT



NOTE:

1. GRIDCONE ⊥ ELECTRIC FIELD MODIFIER MOUNTED ONLY IN ELECTRON CHANNEL.

FIGURE 2.3-2

DETECTOR GEOMETRY

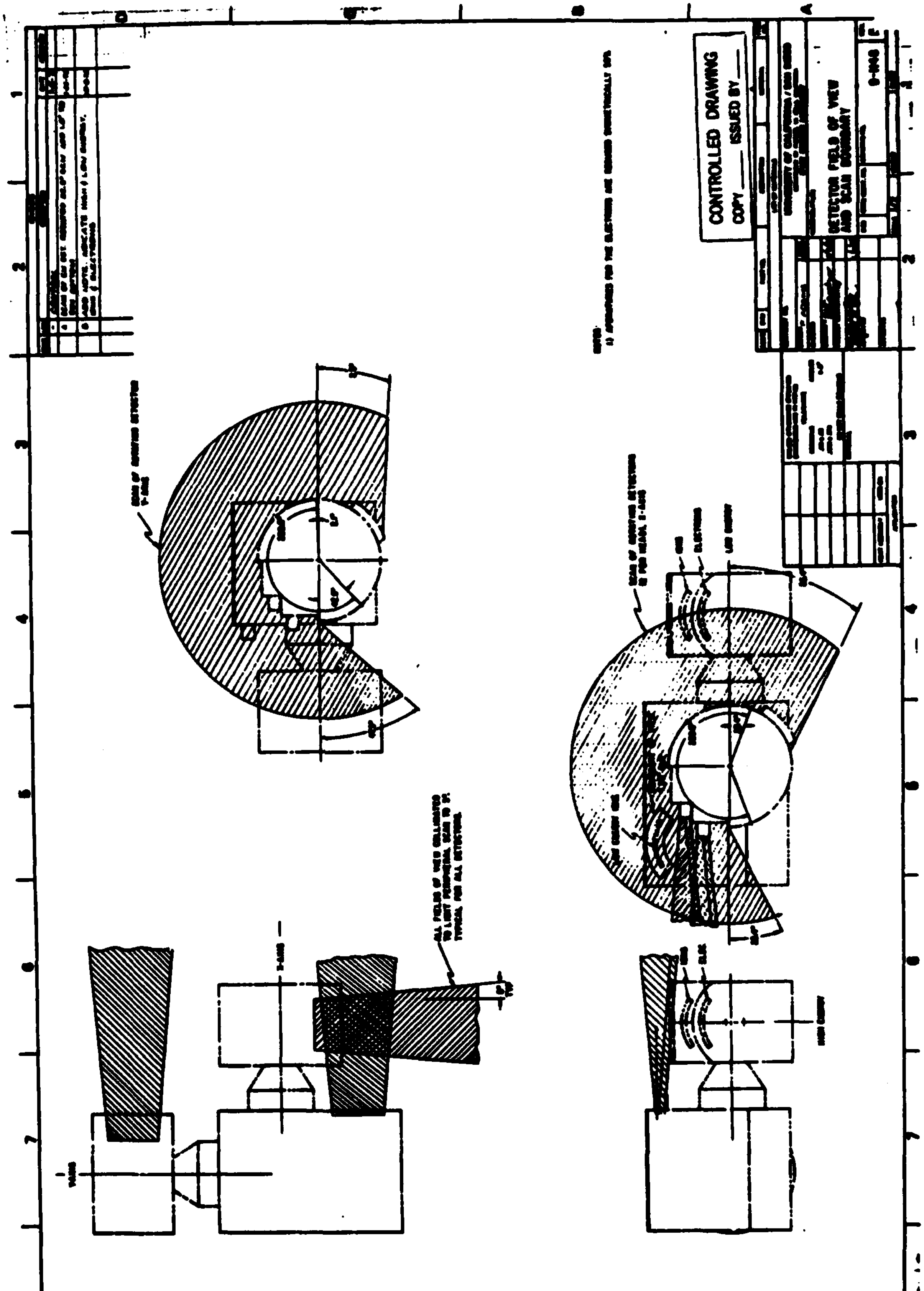


FIGURE 2.3-3

NOMINAL FIELD OF VIEW

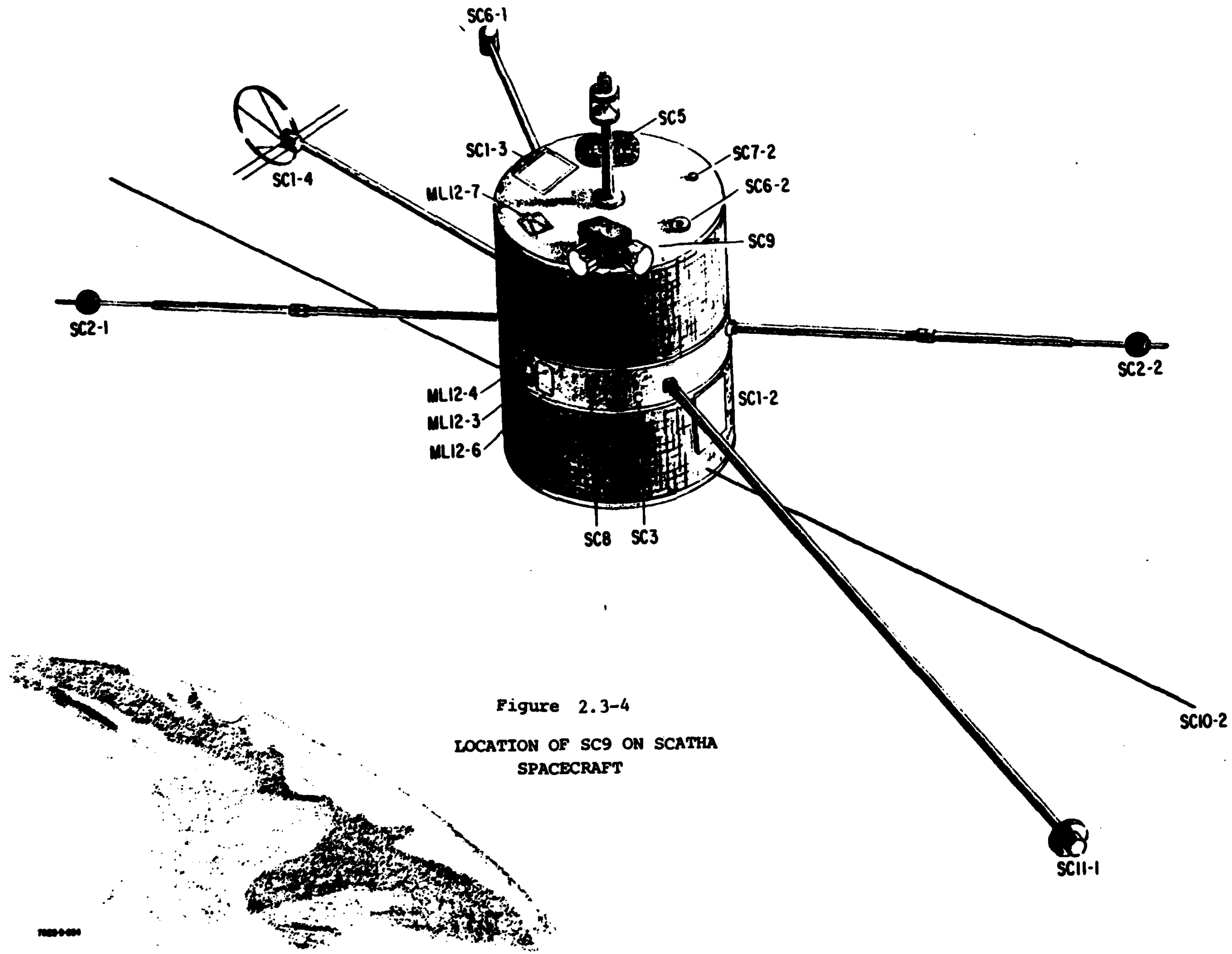


Figure 2.3-4

LOCATION OF SC9 ON SCATHA SPACECRAFT

For a more detailed discussion of energies see Section 2.5.2. The energy resolution DELTA E/E of the analyzer is approximately 20 per cent. The analyzer constant is approximately 11 for each type of detector.

The Electrostatic Lens

A structure made of two wire grids is positioned immediately after the energy analyzer. The first grid is the held at the potential of the inner plate. The second grid is held at the potential of ground. A particle passing through this structure is strongly focused upon the center of the sensor.

The Particle Sensor

A Bendix Model 4213-PAC/WL spiraltron particle sensor detects each charged particle which has passed through the energy analyzer. Pulse electronics attached to this sensor amplifies its output and sets a nominal dead time of 3.3 microseconds. (See Table 2.3-1 for amplifier gain and discriminator levels). This ratelimiting provides a stable well known dead time so that true counting rates of 10^7 counts/second can be measured unambiguously. The high voltage biasing of the spiraltron is illustrated in Figure 2.3-5 and Table 2.3-2 contains the bias voltage for each sensor vs latching command state. The first 1.445 inches of each sensor is shielded with a surrounding gold cylinder 0.040 inches thick. This shield reduces the background rate from penetrating radiation.

Suppression of secondary electrons and some additonal focusing is accomplished by a semi-spherical shield (See Figure 2.3-2) which lies between the sensor and the electrostatic lens. The proton suppressor is at zero potential for each detector assembly. The electron suppressor for the low and high energy detectors are independently controlled by magnitude command and can be at -30 volts continuously or vary with step number as follows;

Low energy detector
Steps 0 thru 31 suppressor voltage is 0.0 volts
Steps 32 thru 63 suppressor voltage is -18.17 volts

High energy detector
Steps 0 thru 15 suppressor voltage is 0.0 volts
Steps 16 thru 63 suppressor voltage is -30.0 volts

TABLE 2.3-1
ATS-F & SCATHA DISCRIMINATION
LEVEL SUMMARY
HIGH ENERGY DETECTORS

UNIT	DETECTOR	AMP GAIN $^{UV}/_{e^-}$	DISC LEVEL MV	DISC LEVEL # e^-	TEST JACK ATTEN.	CROSS COUPLING MV	FLYBACK MV	NOISE MV	THRESHOLD 1 mHz to case via 68Ω
	RDA Ser #05								
	Electron	0.611	90mv	1.35×10^5	10.19	40mv	< 35mv	-35mV	14v P-P
	Proton	0.233	111mv	4.78×10^5	9.411				----
	RDA Ser #06								
SN03	Electron	0.789	90mv	1.14×10^5	14.17	< 30	60	< 30	18v P-P
	Proton	0.160	60mv	3.75×10^5	6.9	30	30	< 20	----
	FDA Ser #								
	Proton	0.171	90mv	5.25×10^5	5.95	20	25	< 20	----
	RDA Ser #03								
	Electron	0.6285	110mv	1.75×10^5	17.14	< 80mv	< 90	30	5.6 *
	Proton	0.199	70mv	3.5×10^5	15.0	30mv	70	20	----
	RDA Ser #04								----
SN02	Electron	0.562	120mv	2.135×10^5	14.1176	< 90	100	4	1.3 VPP*
	Proton		100mv	3.51×10^5	13.57	< 45	90	20	----
	FDA Ser #								
	Proton	0.279	65mv	2.32×10^5	----	----	----	----	----

NOTE: ATS-VI consists of the following:

NSRDA	SN05	FDA	SN03
EWRDA	SN03		

* 68Ω to outer screw balance bar

(Continued)

TABLE 2.3-1
ATS-F & SCATHA DISCRIMINATION
LEVEL SUMMARY
HIGH ENERGY DETECTORS

UNIT	DETECTOR	AMP GAIN UV/e^-	DISC LEVEL MV	DISC LEVEL # e^-	TEST JACK ATTEN.	CROSS COUPLING MV	FLYBACK MV	NOISE MV	THRESHOLD 1 mHz to case via 68Ω
	HDA SN 01								
	ELEC	0.73UV/e^-	240mv	$3.5X10^5$	TBD	TBD	TBD	$2.2X10^5$	TBD
	ION	.387UV/e^-	120mv	$3.1X10^5$	TBD	TBD	TBD	$1.4X10^5$	TBD

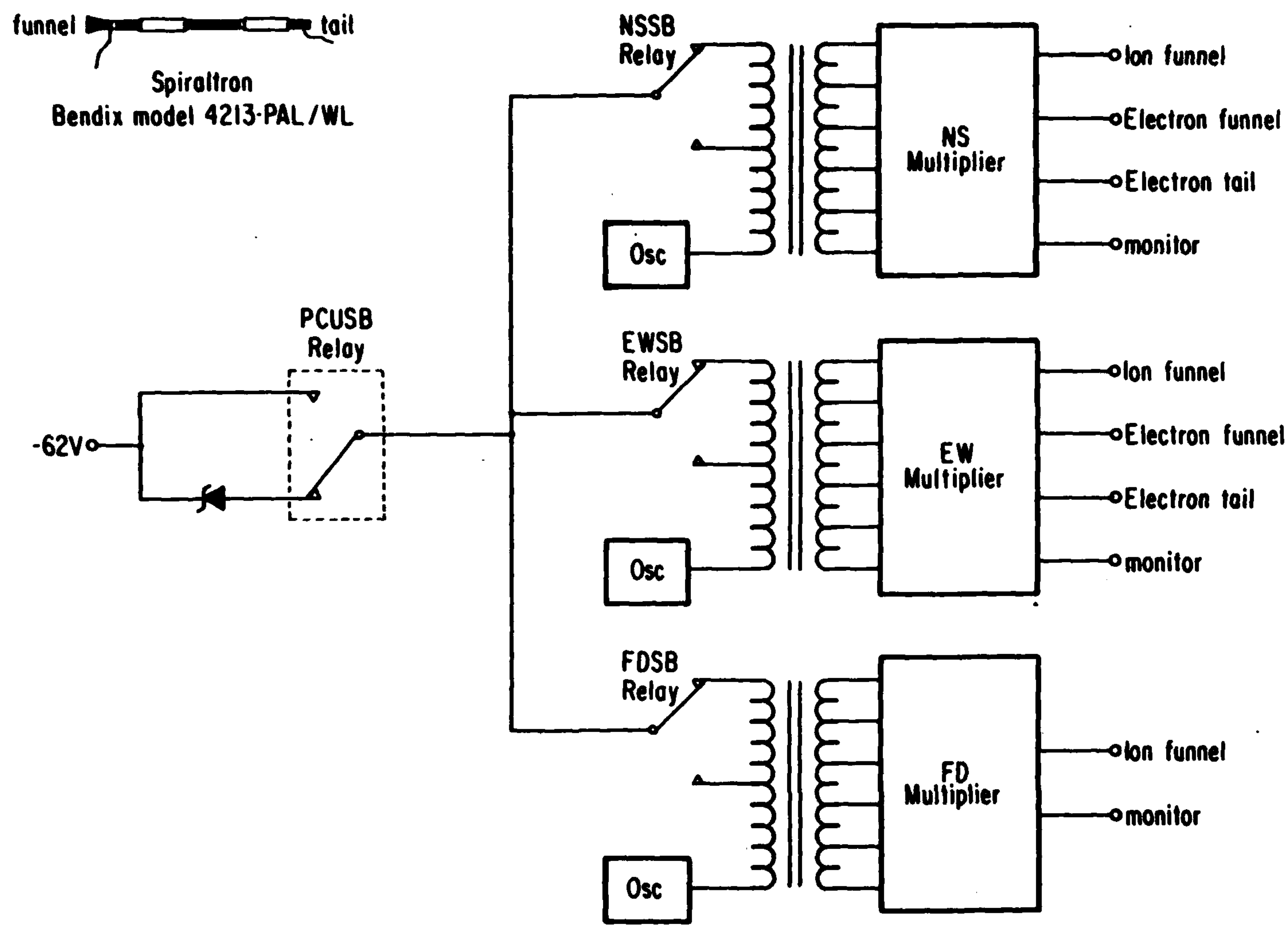


Figure 2.3-5 SPIRALTRON BIAS SCHEME, UCSD/SCATHA SC9

TABLE 2.3-2

SPIRALTRON BIAS VOLTAGES

NS SPIRALTRON BIAS (HIGH ENERGY)

LATCH CMD # 7021	7020	SPIRALTRON VOLTAGES ELECTRON FUNNEL	ELECTRON TAIL	ION FUNNEL	ION TAIL	PERFORMANCE PARAMETERS J4007
0	0	+230	+2660	-2460	~0	1.58
0	1	+272	+3130	-2890	~0	1.80
1	0	SEE NOTE AT PAGE BOTTOM				1.30
1	1	SEE NOTE AT PAGE BOTTOM				1.50

EW SPIRALTRON BIAS (LOW ENERGY)

LATCH CMD # 7022	7020	SPIRALTRON VOLTAGES ELECTRON FUNNEL	ELECTRON TAIL	ION FUNNEL	ION TAIL	PERFORMANCE PARAMETERS J4008
0	0	+210	+2850	-2600	≈0	1.54
0	1	+240	+3180	-2910	≈0	1.76
1	0	+170	+2390	-2190	≈0	1.22
1	1	+200	+2670	-2440	≈0	1.42

FD SPIRALTRON BIAS

LATCH CMD # 7023	7020	SPIRALTRON VOLTAGES ION FUNNEL	ION TAIL	PERFORMANCE PARAMETERS J4009
0	0	2380	≈0	1.38
0	1	-2660	≈0	1.58
1	0	-2890	≈0	1.70
1	1	-3220	≈0	1.96

NOTE: The remaining values were not determined before the spacecraft was launched.

The commands that control the electron suppressor voltage for the low energy rotating detector asembly are:

MAGNITUDE COMMAND #	FUNCTION DWELL STEP SIZE	ELECTRON SUPPRESSOR VOLTAGE
8287	0	0 volts step 0-31, -18.17 volts step 32-63
8101	1	0 volts step 0-31, -18.17 volts step 32-63
8102	2	0 volts step 0-31, -18.17 volts step 32-63
8103	4	0 volts step 0-31, -18.17 volts step 32-63
8104	8	0 volts step 0-31, -18.17 volts step 32-63
8105	16	0 volts step 0-31, -18.17 volts step 32-63
8106	32	0 volts step 0-31, -18.17 volts step 32-63
8291	0	Fixed at -18.17 volts
8292	1	Fixed at -18.17 volts
8293	2	Fixed at -18.17 volts
8294	4	Fixed at -18.17 volts
8295	8	Fixed at -18.17 volts
8296	16	Fixed at -18.17 volts
8297	32	Fixed at -18.17 volts

The commands that control the electron suppressor voltage for the high energy rotating detector assembly are:

MAGNITUDE COMMAND #	3K GATE	ELECTRON SUPPRESSOR VOLTAGE	ACC GATING MODE
8107-8114	PNS	Fixed at -30 volts	0-7
8115-8122	PNS	0 volts step 0-15, -30 volts step 16-63	0-7
8123-8130	ENS	Fixed at -30 volts	0-7
8131-8138	ENS	0 volts step 0-15, -30 volts step 16-63	0-7
8139-8146	PEW	Fixed at -30 volts	0-7
8147-8154	PEW	0 volts step 0-15, -30 volts step 16-63	0-7
8155-8162	EEW	Fixed at -30 volts	0-7
8163-8170	EEW	0 volts step 0-15, -30 volts step 16-63	
8171-8178	PFIX	Fixed at -30 volts	0-7
8179-8186	PFIX	0 volts step 0-15, -30 volts step 16-63	0-7

2.4 DETECTOR COMMANDS AND MODES

The UCSD/SCATHA SC9 experiment is controlled by 21 discrete commands and one 22 bit serial magnitude command.

Latching Command Description - 21 discrete commands are used to set and reset 15 latching relays which in turn provide either 28 volt power or 10 volt logic levels to SC9. Table 2.4-2 provides the function each of the 21 discrete commands perform along with the appropriate number and names. Note that 7002 and all commands that end with the number 5 are used as resets while all others are used as sets.

Magnitude Command Description

SC9 receives from the spacecraft a 22 bit serially command referred to as a magnitude command. Bit utilization for the 22 bit serial command is as shown in Figure 2.4-1.

Note that bits 11 - 14 are used as an address field creating 16 possible addresses for the information in bits 15 - 22 which are referred to as data bits. Bit 15 corresponds to the MSB 2^7 and bit 22 corresponds to the LSB 2 .

Table 2.4-1 is a summary of the 16 addresses in binary, octal and decimal vs. the strobe, the FORTH test name, and description of data transfer.

Table 2.4-3 summarizes by functional grouping the types of commands with typical response values.

For example, the command 10 NSLL would cause the number 10 to be stored in the NSLL register when the strobe STNSLL occurs. The 22 bit field would be as follows:

Bit # MAGNITUDE COMMAND

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
X	X	X	X	X	X	X	0	X	X	0	0	0	0	0	0	0	0	1	0	1	0
X = DON'T CARE										ADDRESS				DATA							

63 DT =

X	X	X	X	X	X	X	0	X	X	0	1	1	0	0	0	1	1	1	1	1	1

255 EWUL =

X	X	X	X	X	X	X	0	X	X	0	0	1	1	1	1	1	1	1	1	1	1

etc,

To facilitate sending magnitude commands in the SCATHA operational environment it was necessary to give each command to be used a number and of course there was a limit on the number of numbers available. Appendix B is the result of that operational constraint and it is called the command list. The command list includes latching commands as well as magnitude commands. Magnitude commands start at command #7100.

Bit Utilization for 22 Bit Serial Command

FIGURE 2.4-1

Bit	Function	Field	Weight	Range
22	CBUS 1	Data	2^0	0 255
21	CBUS 2		2^1	
20	CBUS 3		2^2	
19	CBUS 4		2^3	
18	CBUS 5		2^4	
17	CBUS 6		2^5	
16	CBUS 7		2^6	
15	CBUS 8		2^7	
14	A0 = MC9	Address	2^0	0 15
13	A1 = MC10		2^1	
12	A2 = MC11		2^2	
11	A3 = MC12		2^3	
10	= MC13			
9	= MC14			
8	PCE			
7	PARITY			
6	X = Don't Care			
5	X = Don't Care			
4	X = Don't Care			
3	X = Don't Care			
2	X = Don't Care			
1	X = Don't Care			

TABLE 2.4-1

COMMAND SUMMARY

BINARY ADDRESS $A_3A_2A_1A_0$	OCTAL ADDRESS	DECIMAL ADDRESS	STROBE NAME	FORTH TEST NAME	DESCRIPTION
0 0 0 0	0 0	0	STNSLL	NSLL	Data on CBUS is strobed into NS lower limit register
0 0 0 1	0 1	1	STNSUL	NSUL	Data on CBUS is strobed into NS upper limit register
0 0 1 0	0 2	2	STEWLL	EWLL	Data on CBUS is strobed into EW lower limit register
0 0 1 1	0 3	3	STEWUL	EWUL	Data on CBUS is strobed into EW upper limit register
0 1 0 0	0 4	4	STNSPS	NSPS	Data on CBUS is strobed into NS position register
0 1 0 1	0 5	5	STEWPS	EWPS	Data on CBUS is strobed into EW position register
0 1 1 0	0 6	6	STDT	DT	Data on CBUS is strobed into dwell time register
0 1 1 1	0 7	7	ST DN	DN	Data on CBUS is strobed into dwell number register
1 0 0 0	1 0	8	STID1	ID1	Data on CBUS is strobed into initial dwell step register
1 0 0 1	1 1	9	STDS	DS	Data on CBUS is strobed into dwell step size register
1 0 1 0	1 2	10	STAG	AG	Data on CBUS is strobed into accumulator gating register
1 1 0 1	1 3	11	STMP	MP	Data on CBUS is strobed into motor power register
1 1 0 0	1 4	12	STROBE 12		
1 1 0 1	1 5	13	STROBE 13		
1 1 1 0	1 6	14	STROBE 14		
1 1 1 1	1 7	15	---		

As can be seen from table 2.4-1 there are 12 different address's into which 8 bits of data can be strobed.

The first six addresses (NSLL, NSUL, EWLL, EWUL, NSPS, and EWPS) are used to transfer control bits into the position programmer which controls the rotation of the detector assemblies.

The next four addresses (DT, DN, ID1, AND DS) are used to transfer data into the deflection voltage programmer which determines the scan/dwell program and ultimately the energy of the particles to be analyzed.

The eleventh address (AG) is utilized to control the flow of data from each sensor to the accumulators 1-6 and the 3KHZ channel. In addition, a control bit for the electron suppressor voltage for the high energy detector is included.

Finally, the twelfth address (MP) is utilized to control the power to the motors and the mode of operation of the 3KHZ Channel.

POSITION PROGRAMMER

The position programmer has two identical sections. One section controls the NSRDA (High Energy Dectector) and the other controls the position of the EWRDA (Low Energy Detector).

NSLL NSUL NSPS	CONTROLS ROTATION OF NSRDA
EWLL EWUL EWPS	CONTROLS ROTATION OF EWRDA

See Figure 2.5-1 for Angle Definition

SC9 RELAY COMMAND SUMMARY

TABLE 2.4-2

COMMAND NO.	NAME	TYPE	FUNCTIONAL DESCRIP.	MEAS. NO.	NAME	TLM VALUE
7000	SC9 POWER ON	L	Applied +28V non-critical bus to SC9 low voltage power supply.	J4016	PCUMON	.92+.06VDC
7001	SC9 POWER OFF	U	Removes +28V non-critical bus from SC9 low voltage power supply.	J4016	PCUMON	.03+.06VDC
7002	NS DEFLECTION VOLTAGE INHIBIT(DVINS)	L	Inhibits deflection voltage NSRDA	NOTE: TO VERIFY COMMAND STATUS OF LATCHING CMDS 7002, 7003, 7004, 7011, 7012, 7013, 7020 USE FIG. A. LATCHING COMMAND WILL SET A "1" IN THE APPROPRIATE BIT POSITION, UNLATCH CMDS WILL RESET THE CORRESPONDING BITS TO ZERO.		
7003*	EW DEFLECTION VOLTAGE INHIBIT (DVIEW)	L	Intended to inhibit deflection voltage EWRDA			
7004*	FD DEFLECTION VOLTAGE INHIBIT(DVIFD)	L	Intended to inhibit deflection voltage FDA			

J8545 (LSB)

BIT	8	7	6	5	4	3	2	1
	NOT USED	7020	7013	7012	7011	7004	7003	7002

FIGURE A
LC:1-7

COMMAND NO.	NAME	TYPE	FUNCTIONAL DESCRIP.	MEAS. NO.	NAME	TLM VALUE
7005	UNLATCH COMMANDS 7002, 7003, 7004	U	Removes deflection voltage inhibit function from NS, EW, FD.	J8545	LC:1-7	See Fig. A.
7011	NS SPIRALTRON VOLTAGE ON	L	ON/OFF switch NSRDA spiraltron voltage	J8545	LC:1-7	See Fig. A.

SC9 RELAY COMMAND SUMMARY

Table 2.4-2 Cont.

	(SVONS)		1⇒ON	J4007	SVNS	1.26+.5VDC
7012	EW SPIRALTRON VOLTAGE ON (SVOEW)	L	ON/OFF switch EWRDA spiraltron voltage 1⇒ON	J8545 J4008	LC:1-7 SVEW	See Fig. A. 1.28+.5VDC
7013	FD SPIRALTRON VOLTAGE ON (SVOFD)	L	ON/OFF switch FDA spiraltron voltage 1⇒ON	J8545 J4009	LC:1-7 SVFD	See Fig. A. 1.36+.5VDC
7015	UNLATCH CMDS. 7011, 7012, 7013	U	Unlatches commands 7011, 7012, and 7013	J8545 J4007 J4008 J4009	LC:1-7 SVNS SVEW SVFD	See Fig. A .05+.05VDC " "
7020	PCU SPIRALTRON BIAS (PCUSB)	L	Switch to raise and lower all spiraltron voltages.	J8545	LC:1-7	See Fig. A
7021	NS SPIRALTRON BIAS (NSSB)	L	Switch to raise and lower NS spiraltron voltages	NOTE: TO VERIFY COMMAND STATUS OF LATCHING CMDS 7020, 7021, 7022, 7023, 7030, 7031, 7040, 7041, USE FIG. B. LATCH CMDS WILL SET A "1" IN THE APPROPRIATE BIT POSITION, UNLATCHING CMDS WILL RESET THE CORRESPONDING BITS TO ZERO.		
7023	FD SPIRALTRON BIAS (FDSB	L	Switch to raise and lower FD spiraltron voltages	J8552		

J8552 (LSB)

BIT	8	7	6	5	4	3	2	1
	NOT USED	7 0 4 1	7 0 4 0	7 0 3 1	7 0 3 0	7 0 2 3	7 0 2 2	7 0 2 1

LC: 8-14

FIGURE B

7025	UNLATCH COMMANDS 7020, 7021, 7022, 7023	U	Unlatches 7020, 7021, 7022, and 7023	J8545 J8552	LC:1-7 LC:8-14	See Fig. A See Fig. B
7030	MOTOR POWER (MP)	L	ON/OFF switch on motor voltage supply	J8552	LC:8-14	See Fig. B
7031	MOTOR VOLTAGE (MV)	L	Switch to raise and lower motor voltage	"	"	"

SC9 RELAY COMMAND SUMMARY

Table 2.4-2 cont.

7035	UNLATCH CMDS 7030, 7031	U	Unlatches 7030 and 7031	"	"	"
7040**	MICROPRO-CESSOR BYPASS	L	Intended as a switch to enable micropro-cessor.	J8552	LC:8-14	See Fig. B
7041**	MICROPROCES-SOR OFF	L	Intended as ON/OFF switch microprocessor supply.	"	"	"
7045	UNLATCH 7040, 7041	U	Unlatches 7040 and 7041	"	"	"

* = Changing the EWRDA and EDA to low energy detectors eliminated the need for these commands.

** = The unavailability of the microprocessor eliminated the need for these commands. IMPORTANT NOTE: If 7040 is logical one SC9 will not respond to magnitude commands.

SERIAL COMMAND FUNCTIONS

TABLE 2.4-3

COMMAND NO.	NAME	FUNCTIONAL DESCRIPTION	TELEMETRY REPONSE: MEAS NO.	NAME	TLM VALUE
7100-7279	NSLL Reversal Angle	Programs NS head lower limit register (NSLL) value entered determines NS lower limit head reversal angle. Reversal angles (ω) from -17.6° to +232° in 1.4° increments can be programmed.	J8510	NSLL	Each bit count change of J8510 corresponds to a reversal angle change of 1.4° starting at -17.6°. Thus when J8510=1; ω=-17.6°; J8510=2; ω=-16.2° ↓ ↓ J8510=180; ω=233.0°
7280-7281	Forced Reversal Angle, NSLL	Forces NS head to change direction (from to) immediately, irrespective of angular position	J8510	NSLL	0 (7280) 255 (7291)
7282-7461	NSUL	Programs NS head upper limit register. Programmable values are same as those for NSLL.	J8511	NSUL	Same as NSLL verification, except use J8511.
7462-7463	Forced Reversal Angle, NSUL	Forces NS head to change direction (from to) immediately, irrespective of angular position.	J8511	NSUL	0 (7462) 255 (7463)
7464-7643	EWLL	Programs EW head lower limit register. Programmable values are same as NSLL.	J8512	EWLL	Same as NSLL verfication except use J8512.
7464-7645	Forced Reversal Angle, EWLL	Forces EW head to change direction (from to) immediately, irrespective of angular position.	J8512	EWLL	0 (7462) 255 (7463)
7646-7825	EWUL	Programs EW head upper limit register. Programmable values are same as NSLL.	J8513	EWUL	Same as NSLL verification, except use J8513.

SERIAL COMMAND FUNCTIONS

Table 2.4-3 cont.

7826-7827	Forced Reversal Angle,EWUL	Forces EW head to change direction (from to) immediately, irrespective of angular position.	J8513 EWUL	0 (7826) 255 (7827)
7828	NS Park Immediate	Stops NS head rotation	J8569 NSPS	0000,DCNTS
7829	NS Park at 90°	Command NS head to the +90° park position.	J8569 NSPS J4017 NSPOS J8506 NSPC	160,DCNTS 2.16+.05VDC 308+20,DCNTS
7830	NS Sweep	Command NS head to sweep between its optical limits (-20.4° to +220.8°)	J8569 NSPS J4017 NSPOS J8506 NSPC	164,DCNTS -20° +220° .54 4.46V 0000 0627
7831	NS Park at -20°	Commands NS head to the -20° park position	J8569 NSPS J4017 NSPOS J8506 NSPC	165, DCNTS .72+.06VDC 0000,DCNTS
7832	NS Park at 0°	Commands NS head to the 0° park position	J8569 NSPS J4017 NSPOS J8506 NSPC	166,DCNTS .96+.06VDC 48+,DCNTS
7833	NS park at 180°	Commands NS head to the 180° park position	J8569 NSPS J4017 NSPOS J8506 NSPC	172,DCNTS 3.88+.06VDC 565+,DCNTS
7834	NS park at 200°	Commands NS head to the 200° park position	J8569 NSPS J4017 NSPOS J8506 NSPC	180,DCNTS 4.10,VDC 627+ DCNTS
7835	NS Wag	Commands NS head to wag between NSLL and NSUL.	J8569 NSPS J4017 NSPOS J8506 NSPC	228,DCNTS Limits are dependant on NSLL, NSUL set. "
7836	EW park immediate	Stops EW head rotation	J8570 EWPS	0000,DCNTS
7837	EW park at +90°	Commands EW head to +90° park position	J8570 EWPS J4018 EWPOS J8507 EWPC	160,DCNTS 2.20+.06,VDC 312+,DCNTS
7838	EW sweep	Commands EW had to sweep between its optional limits -20.40° to +220.8°	J8570 EWPS J4018 EWPOS J8507 EWPC	164,DCNTS -20° +220° .54 4.44VDC 0000 0630,DCNTS
7839	EW park at -20°	Commands EW head to -20° park position	J8570 EWPS J4018 EWPOS	165,DCNTS .54+.06,VDC

SERIAL COMMAND FUNCTIONS

Table 2.4-3 cont.

			J8507 EWPS	0000,DCNTS
7840	EW park at 0°	Commands EW head to 0° park position	J8570 EWPS J4018 EWPOS J8507 EWPC	166,DCNTS .74+.06,VDC 49+,DCNTS
7841	EW park at 180°	Commands EW head to the 180° park position	J8570 EWPS J4018 EWPOS J8507 EWPC	172,DCNTS 4.14+.06,VDC 566+,DCNTS
7842	EW park at 200°	Commands EW head to the 200° park position	J8570 EWPS J4018 EWPOS J8507 EWPC	180,DCNTS 4.46+.06,VDC 630+,DCNTS
7843	EW Wag	Commands EW head to wag between EWLL and EWUL.	J8570 EWPS J4018 EWPOS J8507 EWPC	228,DCNTS Limits are dependant on EWLL, EWUL values. "
7844	Scan only			
7845-7908	Dwell Time (DT)	Sets deflection program dwell time Dwell times of 64 seconds to 1 second can be programmed.	J8532 DT	Each bit change of J8532 corresponds to a dwell time (DT) change of 1 seconds starting at 128CNTS. Thus when: J8532=128;DT=64 J8532=129;DT=63 ↓ ↓ J8532=191;DT=1
7909-7972	Dwell Time (DT)			
7973-8004	Start Dwell number (DN)	Selects number of dwell periods (DN) that will occur in one deflection program cycle. DN values from 64 dwells/cycle to 2 dwells/cycle in increments of 2 can be programmed.	J8533 DN	Each bit change of J8533 corresponds to a dwell number change of 2 dwells/cycle starting at 64 dwells/cycle. Thus when: J8533=0;DN=64 dwells/cycle J8533=1;DN=62 dwells/cycle J8533=63;DN=2

SERIAL COMMAND FUNCTIONS

Table 2.4-3 cont.

					dwells/cycle
8005-8036	Preset dwell	Presets the DN register with required DN. Values of 64 dwells/cycle to 2 dwells/cycle can be present. This command will force the start of a new deflection program cycle.	J8533	DN	Same verifications as for "start dwell" command described above.
8037-8100	Initial Step(ID1)	Selects the initial dwell step value of the deflection program. Values ranging from 0-63 can be programmed in increments of 1.	J8534	ID1	Each bit change corresponds to an initial dwell step (ID1) change of 1, starting at 0. Thus when: J8534=0;ID1=0 J8534=1;ID1=1 ↓ ↓ J8534=63;ID1-63
8101-8106	Dwell Step Size(DS)	Selects the dwell step size of the deflection programs. DS values of 1, 2, 4, 8, 16, 32 can be programmed.	J8535	DS	Decimal count value in J8535 gives the dwell step size. Thus when: J8533=1;DS=1 ↓ ↓ J8533=32;DS=32
8107-8234	Accumulator Gating	Determined data mode by selecting one mode of each of the following SC9 data functions FUNCTION — SELECTABLE MODES 3KHz gate broadband data — PNS, ENS, PEW, EEW, PFIX, DISABLE Low energy mode — On, Off Accumulator gating — Normal, fast proton fast electron, SFPNS, SFPEW, SFEEW, SFPFIX Refer to command list to determine modes selected by each command.	J8538	AG	CMD J8538 8101 0 8108 1 8109 2 ↓ ↓ 8234 127

SERIAL COMMAND FUNCTIONS

Table 2.4-3 cont.

8235-8282	Motor Power
8283	NS Position Status, 255
8284	EW Position Status, 255
8287	Dwell Step Size=0
8288	Dwell Step Sieze=255
8289	Accumulator Gating=255
8290	Motor Power =255
8291-8297	

2.5 COMMAND MODES

Due to constraints on the operation of the SCATHA spacecraft, all possible commands cannot be sent in all possible modes. Also the anticipated times to be able to send commands are limited. Faced with this serious inconvenience, the experimenters have been asked to define a subset of useful modes in which to place their instruments. This subset can then exist on the tracking computer disks. A matrix showing possible transitions between these defined modes then indicates the most efficient way of changing from one to another. The ground rules were that no more than 6-10 modes would be defined for any instrument. In the case of SC-9, this has been a severe burden. The instrument was designed to be "flown" in near real time and to be very flexible. However, the following modes have been defined and implemented. They represent a very useful subset of what is possible. Command state outside of those designated here would have to be implemented by defining a command string and having that placed on the disk before the desired satellite pass. The execution of this new command could be scheduled in the same manner as the normal states. The predicted minimum time to design and implement such a new mode is two weeks. Exceptions can be made to support real-time operation (in support of SC-4 for instance).

Note that certain of the magnitude commands can be varied to define different operating conditions within a given mode.

Modes are implemented by automated execution of commmand sequences. These sequences are indicated in the allowed-disallowed transition matrix. The exact definition of the sequences are also given.

UCSD/SCATHA SC9 AURORAL PARTICLES EXPERIMENT

MODE SUMMARY

MODE NO.	MODE TITLE TITLE	POWER CONSUMPTION (NOMINAL + OPER RANGE)	-CONSTRAINTS-
0	OFF/SAFE	0	SC9-CON-2 SC9-CON-3
1	SCAN/SWEEP	15.56 + 3	SC9-CON-01
2	SCAN/DWELL/SWEEP	15.56 ± 3	SC9-CON-01
3	SCAN/PARK	7.56 ± 3 AFTER PARK	SC9-CON-01
4	SCAN/DWELL/PARK	7.56 ± 3 AFTER PARK	SC9-CON-01
5	FAST MIX	7.56 ± 3 IF PARK 15.56 ± 3 IF SWEEP	SC9-CON-01
6	SAFE MODE 2	7.56 ± 3	

UCSD/SCATHA SC9 AURORAL PARTICLES EXPERIMENT

MODE TRANSITION MATRIX

"A" - Allowable Transition. For each Allowable Transition, write appropriate sequence number in box.

"D" - Disallowed Transition

FROM \ TO	MODE-0 OFF/ SAFE	MODE-1 SCAN/ SWEEP	MODE-2 SCAN/ DWELL/ SWEEP	MODE-3 SCAN/ PARK	MODE-4 SCAN/ DWELL/ PARK	MODE-5 FAST MIX	MODE-6 SAFE MODE 2
MODE-0		D	A SC9CMD-1	D	D	D	A SC9CMD-9
MODE-1	A SC9CMD-2		A SC9CMD-3	A SC9CMD-4	D	D	A SC9CMD-9
MODE-2	A SC9CMD-2	A SC9CMD-5		D	A SC9CMD-4	A SC9CMD-6	A SC9CMD-9
MODE-3	A SC9CMD2	A SC9CMD-7	D		A SC9CMD-3	D	A SC9CMD-9
MODE-4	A SC9CMD-2	D	A SC9CMD-7	A SC9CMD-5		D	A SC9CMD-9
MODE-5	A SC9CMD-2	D	A SC9CMD-8	D	D		A SC9CMD-9
MODE-6	A SC9CMD-2	D	A SC9CMD-1	D	D	D	

UCSD/SCATHA SC9 AURORAL PARTICLES EXPERIMENT

COMMAND SEQUENCE SUMMARY

COMMAND SEQUENCE	BLOCK NO.	COMMAND SEQUENCE FUNCTION OR DESCRIPTION	TRANSITION FROM MODE	TO MODE
SC9-CMD-1	B-7050	TURN ON - SET MODE 2	0	2
SC9-CMD-2	B-7060	OFF	1, 2, 3, 4, 5, 6	0
SC9-CMD-3	B-7051	TURN DWELL ON	1 3	2 4
SC9-CMD-4	B-7052	TURN PARK ON	1 2	3 4
SC9-CMD-5	B-7053	TURN DWELL OFF	2 4	1 3
SC9-CMD-6		FAST MIX ON	2	5
SC9-CMD-7		TURN PARK OFF	3 4	1 2
SC9-CMD-8		FAST MIX OFF	5	2
SC9-CMD-9	B-7061	TO SAFEMODE 2	0, 1, 2, 3, 4, 5	6
SC9-CMD-10		SC9 CHECKOUT SEQUENCE	NA	NA

2.5.1 Detector Rotation

NSRDA ROTATION CONTROL (High Energy Detector)

Data transferred to NSPS control register will control the rotation of the High Energy Detector as shown in Table 2.5-1. There are eight modes of operation:

Park Immediate-	Detector will stop immediately upon execution of cmd. 7828 (0 NSPS)
Park 90 Deg.-	Detector will park at 90 Deg. the next time it gets there after the execution of cmd. 7829 (160 NSPS)
Park -20 Deg.-	Detector will park at -20 Deg. the next time it gets there after the execution of cmd. 7831 (165 NSPS)
Park 0 Deg.-	Detector will park at 0 Deg. the next time it gets there after the execution of cmd. 7832 (166 NSPS)
Park 180 Deg.-	Detector will park at 180 Deg. the next time it gets there after the executions of cmd. 7833 (172 NSPS)
Park 200 Deg.-	Detector will park at 200 Deg. the next time it gets there after the execution of cmd. 7834 (180 NSPS)
SWEEP	Detector will sweep between optical limits approximately 200 Deg. after the execution of cmd. 7830 (164 NSPS)
WAG	Detector will rotate between the lower and upper limit. Limits are established by NSLL and NSUL for the high energy detector. Wag will commence after the execution of cmd. 7835 (228 NSPS)

NORTH SOUTH ROTATION CONTROL

TABLE 2.5-1

MAG. CMD. #	NSPS DATA DEC.	NSPS DATA BINARY XXX NSE	NS WAG	NS SWP	NSP 200	NSP 180	NSP 90	NSP 0	NSP -20	NSPS DATA DEC.	NORTH SOUTH DETECTOR WILL:
7828	0	0	0	0	0	0	0	0	0	0	PARK IMMEDIATE
	.	.	.	.	.	.	.	.	.	.	" "
	.	.	.	.	.	.	.	.	.	.	" "
	127	0	1	1	1	1	1	1	1	127	" "
7829	160	1	0	1	0	0	0	0	0	160	Park at 90 Degrees
7830	164	1	0	1	0	0	1	0	0	164	Sweep between optical limits
7831	165	1	0	1	0	0	1	0	1	165	Park at -20 Degrees
7832	166	1	0	1	0	0	1	1	0	166	Park at 0 Degrees
7833	172	1	0	1	0	1	1	0	0	172	Park at 180 Degrees
7834	180	1	0	1	1	0	1	0	0	180	Park at 200 Degrees
7835	228	1	1	1	0	0	1	0	0	228	Wag between upper and lower limit

SC9 - NS SWEEP ANGLE VS POSITION COUNTER

TABLE 2.5-2

UCSD/SCATHA SC9 AURORAL PARTICLES EXPERIMENT
NSRDA (HIGH ENERGY)
SWEEP ANGLE VS POSITION COUNTER AND ANALOG PERFORMANCE MONITOR

TNS= 3.63   TEW= 3.62   TMB= 3.66

POSITION COUNTER NSPC J8506	NSRDA ROTATION ANGLE α°	ANALOG PERFORMANCE NUMBER J4017	NSPC J8506	α°	NSP J4017	NSPC J8506	α°	NSP J4017
0	-19.53	0.74	100	+15.35	1.16	200	+50.23	1.60
4	-18.14	0.76	104	+16.75	1.18	204	+51.63	1.64
8	-16.74	0.78	108	+18.14	1.18	208	+53.02	1.66
12	-15.35	0.80	112	+19.53	1.20	212	+54.42	1.68
16	-13.95	0.82	116	+20.93	1.20	216	+55.81	1.70
20	-12.56	0.84	120	+22.32	1.22	220	+57.21	1.72
24	-11.16	0.88	124	+23.72	1.24	224	+58.60	1.76
28	-9.77	0.90	128	+25.11	1.24	228	+60.00	1.78
32	-8.37	0.92	132	+26.51	1.26	232	+61.39	1.80
36	-6.98	0.94	136	+27.90	1.28	236	+62.79	1.82
40	-5.58	0.96	140	+29.30	1.30	240	+64.19	1.84
44	-4.18	0.98	144	+30.69	1.32	244	+65.58	1.86
48	-2.79	1.00	148	+32.09	1.34	248	+66.98	1.90
52	-1.39	1.02	152	+33.49	1.38	252	+68.37	1.92
56	0.0	1.02	156	+34.88	1.38	256	+69.77	1.94
60	+1.39	1.04	160	+36.30	1.40	260	+71.16	1.96
64	+2.79	1.04	164	+37.67	1.42	264	+72.56	1.98
68	+4.19	1.06	168	+39.06	1.44	268	+73.95	2.00
72	+5.58	1.08	172	+40.46	1.46	272	+75.35	2.02
76	+6.98	1.10	176	+41.86	1.48	276	+76.74	2.04
80	+8.37	1.12	180	+43.25	1.50	280	+78.14	2.08
84	+9.97	1.12	184	+44.65	1.52	284	+79.53	2.10
88	+11.16	1.14	188	+46.04	1.54	288	+80.93	2.12
92	+12.56	1.16	192	+47.44	1.56	292	+82.32	2.14
96	+13.95	1.16	196	+48.83	1.58	296	+83.72	2.16

TABLE 2.5-2 (CONTINUED)

NSPC J8506	α°	NSP J4017	NSPC J8506	α°	NSP J4017	NSPC J8506	α°	NSP J4017
300	+85.12	2.20	400	+120.00	2.74	500	+154.88	3.42
304	+86.51	2.22	404	+121.39	2.76	504	+156.28	3.46
308	+87.90	2.24	408	+122.79	2.78	508	+157.67	3.50
312	+89.30	2.26	412	+124.19	2.80	512	+159.06	3.52
316	+90.70	2.30	416	+125.58	2.82	516	+160.46	3.56
320	+92.09	2.30	420	+126.98	2.86	520	+161.86	3.60
324	+93.49	2.32	424	+128.37	2.88	524	+163.25	3.62
328	+94.88	2.34	428	+129.77	2.90	528	+164.65	3.66
332	+96.28	2.36	432	+131.16	2.92	532	+166.05	3.70
336	+97.67	2.38	436	+132.56	2.96	536	+167.44	3.74
340	+99.07	2.40	440	+133.95	2.98	540	+168.84	3.76
344	+100.46	2.44	444	+135.35	3.00	544	+170.23	3.82
348	+101.86	2.44	448	+136.74	3.04	548	+171.63	3.84
352	+103.26	2.48	452	+138.14	3.08	552	+173.02	3.86
356	+104.65	2.50	456	+139.53	3.10	556	+174.42	3.90
360	+106.05	2.50	460	+140.93	3.12	560	+175.81	3.94
364	+107.44	2.54	464	+142.33	3.14	564	+177.21	3.98
368	+108.83	2.56	468	+143.72	3.18	568	+178.60	4.00
372	+110.23	2.58	472	+145.12	3.20	572	+180.00	4.00
376	+111.62	2.60	476	+146.51	3.22	576	+181.39	4.04
380	+113.02	2.62	480	+147.90	3.26	580	+182.79	4.08
384	+114.42	2.66	484	+149.30	3.30	584	+184.17	4.08
388	+115.81	2.66	488	+150.70	3.32	588	+185.58	4.12
392	+117.21	2.70	492	+152.09	3.36	592	+186.98	4.14
396	+118.60	2.72	496	+153.49	3.40	596	+188.37	4.14

TABLE 2.5-2 (CONTINUED)

NSPC J8506	α°	NSP J4017
600	+189.76	4.16
604	+191.16	4.16
608	+192.56	4.18
612	+193.95	4.18
616	+195.34	4.20
620	+196.74	4.22
624	+198.14	4.22
628	+199.53	4.22

EWRDA ROTATION CONTROL (Low Energy Detector)

Data transferred to EWPS control register will control the rotation of the Low Energy Detector as shown in Table 2.5.2-3 There are eight modes of operation:

Park Immediate-	Detector will stop immediately upon execution of of cmd. 7836 (0 EWPS)
Park 90 Deg.-	Detector will park at (90 + 22.5) Deg. the next time it gets there after the execution of cmd. 7837 (160 EWPS)
Park -20 Deg.-	Detector will park at (-20 + 22.5) Deg. the next time it gets there after the execution of cmd. 7839 (165 EWPS)
Park 0 Deg.-	Detector will park at (0 + 22.5) Deg. the next time it gets there after the execution of cmd. 7840 (166 EWPS)
Park 180 Deg.-	Detector will park at (180 +22.5) Deg. the next time it gets there after the execution of cmd. 7841 (172 EWPS)
Park 200 Deg.-	Detector will park at (200 + 22.5) Deg. the next time it gets there after the execution of cmd. 7842 (180 EWPS)
Sweep-	Detector will sweep between optical limits approximately 220 Degrees after the execution of cmd. 7838 (164 EWPS)
Wag-	Detector will rotate between the lower and upper limit. Limits are established by EWLL and EWUL for the Low Energy Detector. Wag will commence after the execution of cmd. 7843 (228 EWPS)

TABLE 2.5-3

EAST WEST ROTATION CONTROL

MAG. CMD. #	EWPS DATA DEC.	EWPS DATA BINARY EWE	EW WAG	EW SWP	EWP 200	EWP 180	EWP 90	EWP 0	EWP -20	EWPS DATA DEC.	EAST WEST DETECTOR WILL:
7836	0	0	0	0	0	0	0	0	0	0	PARK IMMEDIATE
	.	.	.	.	.	.	.	.	.	. .	" "
	.	.	.	.	.	.	.	.	.	.	" "
	127	0	1	1	1	1	1	1	1	127	" "
7837	160	1	0	1	0	0	0	0	0	160	Park at (90 + 22.5) degrees
7839	164	1	0	1	0	0	1	0	0	164	Sweep between optical limits
7839	165	1	0	1	0	0	1	0	1	165	Park at (-20 + 22.5) degrees
7840	166	1	0	1	0	0	1	1	0	166	Park at (0 + 22.5) degrees
7841	172	1	0	1	0	1	1	0	0	172	Park at (180 + 22.5) degrees
7842	180	1	0	1	1	0	1	0	0	180	Park at (200 + 22.5) degrees
7843	228	1	1	1	0	0	1	0	0	228	Wag between upper and lower limit

TABLE 2.5-4

UCSD/SCATHA SC9 AURORAL PARTICLES EXPERIMENT
EWRDA (LOW ENERGY)

SWEEP ANGLE VS POSITION COUNTER AND ANALOG PERFORMANCE MONITOR

TNS= 3.63 TEW= 3.62 TMB= 3.66

POSITION COUNTER EWPC J8507	EWRDA ROTATION ANGLE $\phi°$	ANALOG PERFORMANCE MONITOR EWP J4018	EWPC J8507	$\phi°$	EWP J4018	EWPC J8507	$\phi°$	EWP J4018
0	-19.53	0.56	100	+15.35	0.96	200	+50.23	1.48
4	-18.14	0.56	104	+16.75	1.00	204	+51.63	1.50
8	-16.74	0.58	108	+18.14	1.00	208	+53.02	1.54
12	-15.35	0.60	112	+19.53	1.02	212	+54.42	1.56
16	-13.95	0.62	116	+20.93	1.04	216	+55.81	1.58
20	-12.56	0.64	120	+22.32	1.04	220	+57.21	1.60
24	-11.16	0.66	124	+23.72	1.06	224	+58.60	1.62
28	-9.77	0.66	128	+25.11	1.08	228	+60.00	1.66
32	-8.37	0.68	132	+26.51	1.10	232	+61.39	1.68
36	-6.98	0.70	136	+27.90	1.12	236	+62.79	1.70
40	-5.58	0.72	140	+29.30	1.14	240	+64.19	1.72
44	-4.18	0.74	144	+30.69	1.16	244	+65.58	1.76
48	-2.79	0.76	148	+32.09	1.18	248	+66.98	1.78
52	-1.39	0.78	152	+33.49	1.20	252	+68.37	1.80
56	0.0	0.78	156	+34.88	1.22	256	+69.77	1.82
60	+1.39	0.80	160	+36.30	1.24	260	+71.16	1.86
64	+2.79	0.82	164	+37.67	1.26	264	+72.56	1.88
68	+4.19	0.84	168	+39.06	1.30	268	+73.95	1.90
72	+5.58	0.84	172	+40.46	1.32	272	+75.35	1.92
76	+6.98	0.88	176	+41.86	1.34	276	+76.74	1.96
80	+8.37	0.90	180	+43.25	1.36	280	+78.14	1.98
84	+9.97	0.92	184	+44.65	1.38	284	+79.53	2.00
88	+11.16	0.94	188	+46.04	1.40	288	+80.93	2.04
92	+12.56	0.96	192	+47.44	1.44	292	+82.32	2.06
96	+13.95	0.96	196	+48.83	1.46	296	+83.72	2.64

Table 2.5-4 (CONTINUED)

EWPC J8507	$\phi°$	EWP J4018	EWPC J8507	$\phi°$	EWP J4018	EWPC J8507	$\phi°$	EWP J4018
300	+85.12	2.10	400	+120.00	2.66	500	+154.88	3.48
304	+86.51	2.14	404	+121.39	2.68	504	+156.28	3.52
308	+87.90	2.16	408	+122.79	2.72	508	+157.67	3.56
312	+89.30	2.18	412	+124.19	2.74	512	+159.06	3.60
316	+90.70	2.20	416	+125.58	2.76	516	+160.46	3.64
320	+92.09	2.24	420	+126.98	2.80	520	+161.86	3.68
324	+93.49	2.26	424	+128.37	2.82	524	+163.25	3.72
328	+94.88	2.28	428	+129.77	2.86	528	+164.65	3.76
332	+96.28	2.30	432	+131.16	2.88	532	+166.05	3.80
336	+97.67	2.32	436	+132.56	2.90	536	+167.44	3.84
340	+99.07	2.34	440	+133.95	2.94	540	+168.84	3.88
344	+100.46	2.36	444	+135.35	2.98	544	+170.23	3.92
348	+101.86	2.38	448	+136.74	3.02	548	+171.63	3.98
352	+103.26	2.38	452	+138.14	3.04	552	+173.02	4.02
356	+104.65	2.42	456	+139.53	3.08	556	+174.42	4.06
360	+106.05	2.44	460	+140.93	3.12	560	+175.81	4.10
364	+107.44	2.46	464	+142.33	3.14	564	+177.21	4.14
368	+108.83	2.48	468	+143.72	3.18	568	+178.60	4.16
372	+110.23	2.50	472	+145.12	3.20	572	+180.00	4.22
376	+111.62	2.52	476	+146.51	3.24	576	+181.39	4.24
380	+113.02	2.54	480	+147.90	3.28	580	+182.79	4.28
384	+114.42	2.56	484	+149.30	3.32	584	+184.17	4.32
388	+115.81	2.60	488	+150.70	3.36	588	+185.58	4.34
392	+117.21	2.62	492	+152.09	3.40	592	+186.98	4.36
396	+118.60	2.64	496	+153.49	3.44	596	+188.37	4.40

Table 2.5-4 (CONTINUED)

EWPC J8507	$\phi°$	EWP J4018
600	+189.76	4.42
604	+191.16	4.44
608	+192.56	4.46
612	+193.95	4.46
616	+195.34	4.48
620	+196.74	4.50
624	+198.14	4.52
628	+199.53	4.52

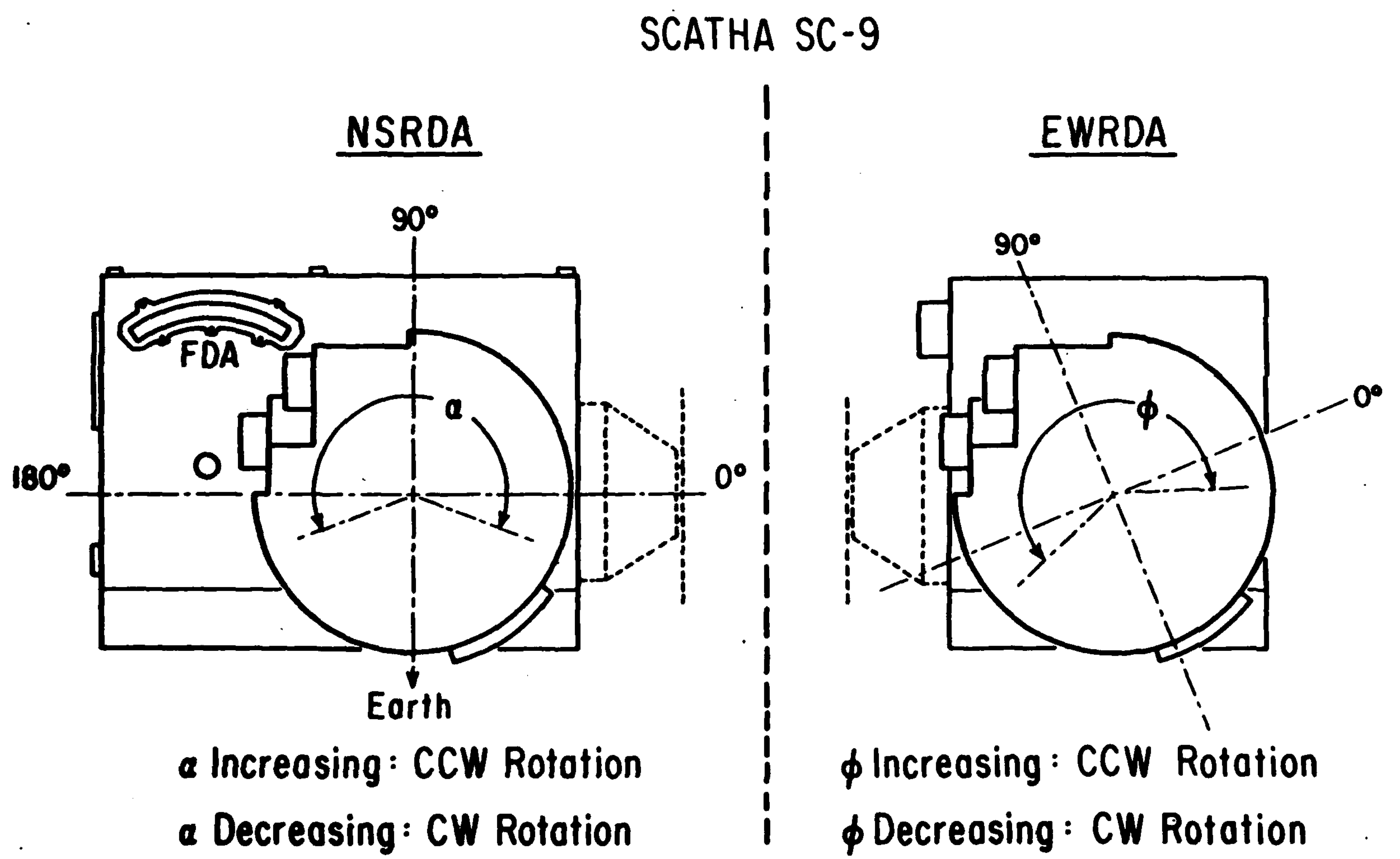


Figure 2.5-1

ANGLE DEFINITION

Table 2.5-2 summarizes detector rotation angle vs position counter and analog performance monitor for NSRDA.

Table 2.5-4 summarizes detector rotation angle vs position counter and analog performance monitor for EWRDA.

2.5.2 Detector Energy Levels

DEFLECTION VOLTAGE PROGRAMMER

Scan - The simplest energy program available is called scan. In this program, the analyzer scans sequentially through 64 discrete exponentially spaced energy levels. The program starts at the lowest energy level E0 and proceeds to the highest energy E63. Each energy level is maintained for 250 ms before proceeding to the next energy level. Transition time between energy levels is assumed to be negligible. The scan only mode of operation is simply a mode in which the analyzer energy is controlled by consecutive scan programs. Execution of magnitude command number 7844 will cause all of the electrostatic analyzer's to operate in the scan only mode.

Scan-Dwell Program - This program starts with a single scan as described above. At the completion of the scan the analyzer will then jump to a predetermined energy level ID1 (one of the 64 scan energy levels) and maintain than energy level (DWELL) for a predetermined length of time DT. At the completion of the dwell the analyzer will perform a scan program and then dwell at the next dwell energy level E(ID1 + DS), where DS is the number of discrete energy levels or steps between adjacent dwells of the same scan dwell program. This process continues until a predetermined number of dwells (ND) have occurred at which time the program repeats.

The following parameters define the scan dwell program and are controllable by magnitude commands:

MAGNITUDE COMMAND #	PARAMETER	DEFINITION
7845-7972	DT	The length of time each dwell is maintained
7973-8036	DN	The number of dwells in a scan-dwell program
8037-8100	ID1	The initial dwell energy level of a scan dwell program
8101-8106 8291-8297	DSS	The number of discrete energy levels between adjacent dwells of the same program

Figure 2.5-2 illustrates typical scan and scan dwell programs.

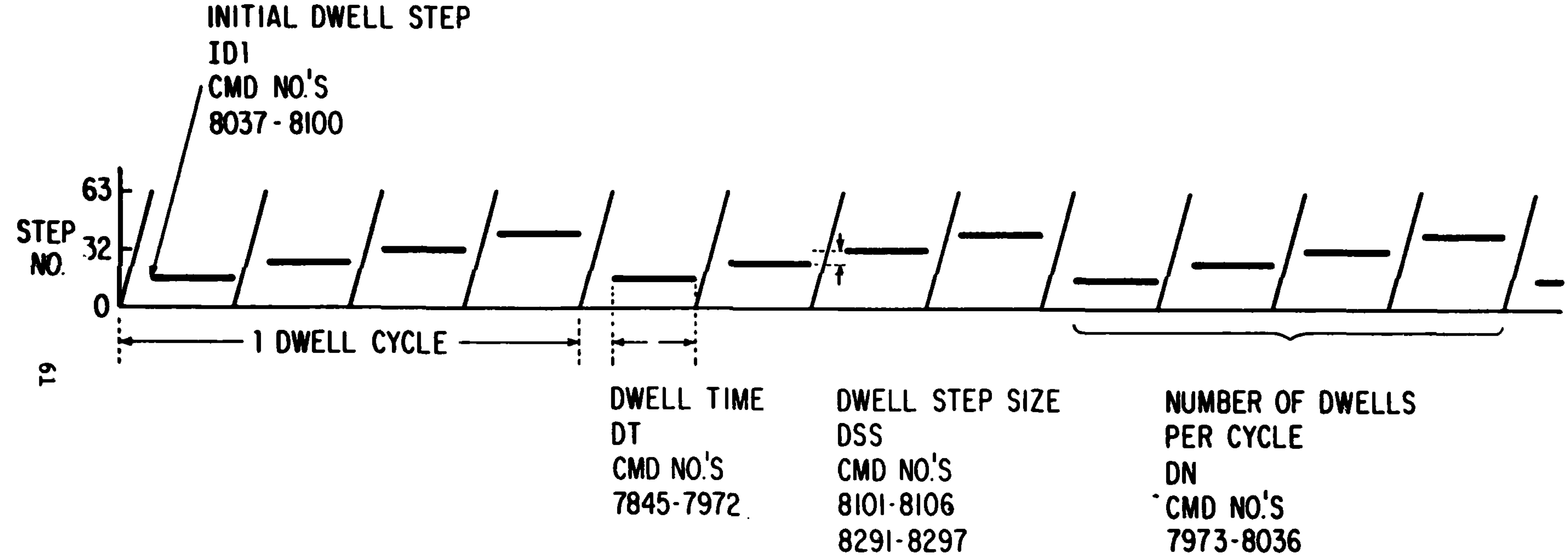


Figure 2.5-2

TYPICAL SCAN DWELL PROGRAM

78ES-9-003

DETECTOR ENERGY

NOMINAL VALUE

The power supply which drives the plates of the detector's energy analyzer can be programmed to supply any one of 64 voltage steps. (see page 5 of the current SC-9 Handbook for more information on the energy analyzer) Nominally, the voltage applied to the plates should be: Eo = -21 + 16.1 * (1.145 ** S) where S is the desired energy step. A graph of the log10(energy applied) vs step number is provided.

CORRECTIONS

In the high energy detectors, (North-South detectors) the actual voltage of the analyzer is not the nominal voltage Eo. One must also take into account a temperature dependent transient response voltage which occurs following the transition from a high energy step to a low energy step.

Whenever the voltage of the analyzers drops from a high value to a low value, a voltage offset occurs. Normally, this happens during the transition from a scan period to a dwell period. This offset voltage behaves unpredictably for the first 1/4 to 1/2 seconds after the transition, and then decays away with a 1/(t+c) reponse. Because of the beginning unpredictability, the first few data points after the transition are thrown out. The transient response of the offset voltage then causes the energy analyzer to slowly sweep down through

higher voltages than originally intended.

In order to compensate for this extra voltage, a correction to the nominal energy value, Eo, must be made. The form of this correction is:

E(total energy of analyzer) = Eo + C1[1/(4t+C2) + 1/(4 * dwell time + C3) - 1/C4],

where:

C1 is of the form: A + Bexp(C * T), with:

A = 18.3

B = 0.43

C = 0.06

T = temperature in degrees centigrade

4t = 4 * time since transition.

= number of steps since end of scan

For all dwell lengths:

C2 = 1

C3 = 65

C4 = 97

This E(total) is computed for all dwell lengths, and for both scan/dwell and scan only modes. NOTE: The last two terms of E(total) cancel for dwell periods of 8 seconds.

Finally, when the preceding dwell is at a high energy step, a fourth term becomes important in determining the energy during the

following scan period. Again, the transition is from a high energy step to a low energy step, but now it is from the end of a dwell to the beginning of a scan. This fourth term is:

E3 = [[-21 + 16.1 * (1.145 ** (dwell step)]/81557] * [C1/(S + 1)]

where S is the energy step number.

Thus, the total energy during a scan is equal to:

E(total) = Eo + C1[1/(4t+1) + 1/(4t+ 65) - 1/97] + E3

Note: E3 is not added in during a dwell period.

As E3 is very small if the dwell energy step is low, it is always computed and added in during all scan periods except when the instrument is in the scan only mode.

The constants A,B and C in the C1 correction value were determined using NS Electron data. During a very low energy dwell, the analyzer energy will sweep through the photoelectron spike and a C1 value can be choosen to fit the dwell spectrum to the scan spectrum which follows it. This fit was done for three different temperatures: 8,13 and 17 degrees centigrade, which seems to be a typical temperature spread of the detector heads. The above form of C1 as a function of temperature was assumed, and the constants were solved for algebraically. Unfortunately, as the temperature spread is small, the accuracy of A,B and C is hard to determine.

HIGH ENERGY DETECTOR

Typical values for E0-E63 for electrons and ions for the scan following a 32 second dwell are given in Table 2.5-6 . The energy equation is included with the table. A nominal room temperature C1 value has been choosen. Table 2.5-5 summarizes energy analyzed versus dwell step number and accumulation interval with C1 again taken as the nominal room temperature value.

LOW ENERGY DETECTOR

Typical values for E0-E63 for electrons and ions for the low energy detector are given in Table 2.5-7 .

TABLE 2.5-5
HIGH ENERGY DETECTOR
ENERGY ANALYZED VS DWELL STEP NO.
AND ACCUMULATION INTERVAL

E = -21 + 16.1*(1.145**S) + 20./(N+1)
E FOR LOW ENERGY DWELL IN SCAN-DWELL CYCLE(ROOM TEMP)

N	S = 0	1	2	3	4	5	6	7	8	9	10	11
0												
1												
2	4.453	6.760	9.441	12.791	16.086	20.018	24.613	29.873	35.894	42.793	50.690	59.731
3	2.100	4.434	7.108	10.168	13.672	17.685	22.279	27.540	33.563	40.460	48.356	57.398
4	.700	3.034	5.708	8.768	12.272	16.285	20.879	26.140	32.163	39.060	46.956	55.998
5	-.233	2.101	4.774	7.835	11.339	15.352	19.946	25.206	31.230	38.126	46.023	55.065
6	-.900	1.434	4.108	7.168	10.672	14.685	19.279	24.540	30.563	37.460	45.356	54.398
7	-1.400	.934	3.608	6.668	10.172	14.185	18.779	24.040	30.063	36.960	44.856	53.898
8	-1.789	.546	3.219	6.279	9.784	13.796	18.390	23.651	29.674	36.571	44.467	53.509
9	-2.100	.234	2.908	5.968	9.473	13.485	18.079	23.340	29.363	36.260	44.156	53.198
10	-2.355	-.020	2.653	5.714	9.218	13.230	17.825	23.085	29.109	36.005	43.902	52.943
11	-2.567	-.232	2.441	5.501	9.006	13.018	17.613	22.873	28.896	35.793	43.690	52.731
12	-2.746	-.412	2.261	5.322	8.826	12.839	17.433	22.694	28.717	35.614	43.510	52.552
13	-2.900	-.566	2.108	5.168	8.672	12.685	17.279	22.540	28.563	35.460	43.356	52.398
14	-3.033	-.699	1.974	5.035	8.539	12.552	17.146	22.406	28.430	35.326	43.223	52.265
15	-3.150	-.816	1.858	4.918	8.422	12.435	17.029	22.290	28.313	35.210	43.106	52.148
16	-3.253	-.918	1.755	4.815	8.320	12.332	16.926	22.187	28.210	35.107	43.003	52.045
17	-3.344	-1.010	1.663	4.724	8.228	12.241	16.835	22.095	28.119	35.015	42.912	51.954
18	-3.426	-1.092	1.581	4.642	8.146	12.159	16.753	22.013	28.037	34.933	42.830	51.872
19	-3.500	-1.166	1.507	4.568	8.072	12.085	16.679	21.940	27.963	34.860	42.756	51.798
20	-3.567	-1.232	1.441	4.501	8.006	12.018	16.613	21.873	27.896	34.793	42.690	51.731
21	-3.627	-1.293	1.380	4.441	7.945	11.958	16.552	21.813	27.836	34.732	42.629	51.671
22	-3.683	-1.348	1.325	4.385	7.890	11.902	16.497	21.757	27.780	34.677	42.574	51.615
23	-3.733	-1.399	1.274	4.335	7.839	11.852	16.446	21.706	27.730	34.626	42.523	51.565
24	-3.780	-1.446	1.229	4.288	7.792	11.805	16.399	21.660	27.683	34.580	42.476	51.518
25	-3.823	-1.489	1.184	4.245	7.749	11.762	16.356	21.617	27.640	34.537	42.433	51.475
26	-3.863	-1.528	1.145	4.205	7.710	11.722	16.316	21.577	27.600	34.497	42.393	51.435
27	-3.900	-1.566	1.108	4.168	7.672	11.685	16.279	21.540	27.563	34.460	42.354	51.398
28	-3.934	-1.600	1.075	4.134	7.638	11.650	16.245	21.505	27.529	34.425	42.322	51.364
29	-3.967	-1.632	1.041	4.101	7.606	11.618	16.213	21.473	27.496	34.393	42.290	51.331
30	-3.997	-1.662	1.011	4.071	7.576	11.588	16.183	21.443	27.466	34.363	42.260	51.301
31	-4.025	-1.691	.983	4.043	7.547	11.560	16.154	21.415	27.438	34.335	42.231	51.273
32	-4.052	-1.717	.956	4.017	7.521	11.533	16.128	21.388	27.412	34.308	42.205	51.247
33	-4.076	-1.742	.931	3.992	7.496	11.509	16.103	21.363	27.387	34.283	42.180	51.222
34	-4.100	-1.766	.906	3.968	7.472	11.485	16.079	21.340	27.363	34.260	42.155	51.198
35	-4.122	-1.788	.885	3.946	7.450	11.463	16.057	21.318	27.341	34.237	42.134	51.176
36	-4.143	-1.809	.864	3.925	7.429	11.442	16.036	21.297	27.320	34.216	42.113	51.155
37	-4.163	-1.829	.844	3.905	7.409	11.422	16.016	21.277	27.300	34.197	42.093	51.135
38	-4.182	-1.848	.825	3.886	7.390	11.403	15.997	21.258	27.281	34.178	42.074	51.116
39	-4.200	-1.866	.808	3.868	7.372	11.385	15.979	21.240	27.263	34.160	42.056	51.098
40	-4.217	-1.883	.790	3.851	7.355	11.368	15.962	21.223	27.246	34.143	42.039	51.081

TABLE 2.5-6
TYPICAL VALUES FOR E0 - E63
FOR
HIGH ENERGY DETECTOR

E = -21 + 16.1*(1.145**S) + 20./(P+1)
32 SECOND DWELL , N = 128 + S (ROOM TEMP)

S	E	*	S	E	*	S	E	*
0	-4.68	*	22	295.81	*	43	5417.45	*
1	-2.35	*	23	341.72	*	44	6206.00	*
2	.32	*	24	394.29	*	45	7100.89	*
3	3.38	*	25	454.49	*	46	8142.70	*
4	6.88	*	26	523.39	*	47	9326.41	*
5	10.89	*	27	602.30	*	48	10681.76	*
6	15.49	*	28	692.65	*	49	12233.63	*
7	20.75	*	29	796.11	*	50	14010.53	*
8	26.77	*	30	914.56	*	51	16045.00	*
9	33.66	*	31	1050.10	*	52	18374.64	*
10	41.56	*	32	1205.40	*	53	21041.98	*
11	50.60	*	33	1383.30	*	54	24096.09	*
12	60.95	*	34	1586.90	*	55	27593.05	*
13	72.80	*	35	1820.02	*	56	31597.06	*
14	86.37	*	36	2086.94	*	57	36181.66	*
15	101.91	*	37	2392.57	*	58	41431.02	*
16	119.71	*	38	2742.51	*	59	47441.54	*
17	140.08	*	39	3143.19	*	60	54323.58	*
18	163.41	*	40	3601.97	*	61	62203.53	*
19	190.12	*	41	4127.28	*	62	71226.06	*
20	220.70	*	42	4728.76	*	63	81556.86	*
21	255.72							

TABLE 2.5-7

TYPICAL VALUES E0 - E63

FOR LOW ENERGY DETECTOR

Step #	Energy in EV	Step #	Energy in EV
0	-0.334	32	26.26
1	-0.29	33	30.10
2	-0.23	34	34.57
3	-0.16	35	39.70
4	-0.08	36	45.55
5	0.00	37	52.22
6	0.09	38	60.00
7	0.22	39	68.77
8	0.34	40	78.55
9	0.50	41	90.10
10	0.67	42	103.32
11	0.87	43	118.32
12	1.10	44	135.65
13	1.36	45	155.43
14	1.66	46	178.09
15	2.00	47	203.98
16	2.39	48	233.42
17	2.83	49	267.20
18	3.34	50	306.30
19	3.94	51	350.74
20	4.60	52	401.96
21	5.37	53	457.73
22	6.25	54	525.50
23	7.25	55	601.05
24	8.40	56	687.71
25	9.72	57	787.70
26	11.23	58	902.13
27	12.96	59	1033.23
28	14.96	60	1184.33
29	17.23	61	1355.42
30	19.83	62	1529.85
31	22.8	63	1777.60

2.6 ACCUMULATOR GATING

The magnitude command AG controls three features of the SC9 experiment:

1) controls flow of data into the 3KHZ channel

2) controls the electron suppressor voltage on the High Energy Detector as described in section 2.2-1

3) controls flow of data from each of the five detectors into the six accumulators.

3KHZ Gating- The flow of data into the 3KHZ Channel is controled by magnitude command AG as follows;

MAGNITUDE COMMAND NUMBER	INPUT DATA TO 3KHZ CHANNEL
8107 THRU 8122	ION DATA HIGH ENERGY DETECTOR (PNS)
8123 THRU 8138	ELECTRON DATA HIGH ENERGY DETECTOR (ENS)
8139 THRU 8154	ION DATA LOW ENERGY DETECTOR (PEW)
8155 THRU 8170	ELECTRON DATA LOW ENERGY DETECTOR (EEW)
8171 THRU 8186	ION DATA FIXED DETECTOR (PFIX)

Electron Suppressor Voltage High Energy Detector-As described in section 2.3.1.

Accumulator gating - There are eight modes of accumulator gating. During scan in any of the modes, the data is always routed the same way. During dwell, the accumulator assignments change and the accumulation intervals change. Table 2.6-1 and 2.6-2 summarizes the contents of the six accumulators vs. mode. Finally, the logic equations for the accumulator gating is presented in figure 2.6-1.

TABLE 2.6-1

ACCUMULATOR GATING

5/13/76 - EMS
Rev. 10/9/76

MAGNITUDE COMMAND NUMBER	ACCUMULATOR COMMANDS OCTAL	AG0	AG1	AG2	MODE NOMENCLATURE ACC.TIME ms	CONTENTS OF ACC # ___ DURING SCAN 1	2	3	4	5	6	CONTENTS OF ACC # ___ DURING DWELL 1	2	3	4	5	6
8107, 8115,...8227	0	0	0	0	Normal T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PNS 249.99	ENS 249.99	PEW 249.99	EEW 249.99	PFIX 124.99	PFIX 125
8108, 8116,...8228	1	1	0	0	Fast Ion T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PNS 124.99	PNS 125	PEW 124.99	PEW 125	PFIX 124.99	PFIX 125
8109, 8117,...8229	2	0	1	0	Fast Mix T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PNS 124.99	PNS 125	ENS 124.99	ENS 125	EEW 124.99	EEW 125
8110, 8118,...8230	3	1	1	0	SFPNS T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PNS 62.5	PNS 62.5	PNS 62.5	PNS 62.5	ENS 249.99	PEW 249.99
8111, 8119,...8231	4	0	1	1	SFENS T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	ENS 62.5	ENS 62.5	ENS 62.5	ENS 62.5	PNS 249.99	EEW 249.99
8112, 8120,...8232	5	1	0	1	SFPEW T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PEW 62.5	PEW 62.5	PEW 62.5	PEW 62.5	EEW 249.99	PNS 249.99
8113, 8121,...8233	6	0	1	1	SFEEW T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	EEW 62.5	EEW 62.5	EEW 62.5	EEW 62.5	PEW 249.99	ENS 249.99
8114, 8122,...8234	7	1	1	1	SFPFIX T	PNS 234	ENS 234	PEW 234	EEW 234	PFIX 117	PFIX 117	PFIX 62.5	PFIX 62.5	PFIX 62.5	PFIX 62.5	PNS 249.99	PEW 249.99
MEASUREMENT NO.'s						J4501	J4566	J4502	J4567	J4503	J4568	J4501	J4566	J4502	J4567	J4503	J4568

ACCUMULATOR INFORMATION

7/12/77

TABLE 2.6-2

MEASUREMENTS	ACCUMULATOR	NOMENCLATURE	SCAN M0-M7	DWELL M0	M1	M2	M3	M4	M5	M6	M7
J4501	ACC #1	DATA	PNS	PNS	PNS	PNS	PNS	ENS	PEW	EEW	PFIX
		ACI	2-31	$\overline{S12}$	S8.$\overline{S12}$	S8.$\overline{S12}$	S4.$\overline{S12}$	S4.$\overline{S12}$	S4		
		T in ms	234	249.99	124.99	124.99	62.59	62.49	62.49	62.49	62.49
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	ODD SUBFRAMES TELEMETRY WORDS 104,105								
J4566	ACC #2	DATA	ENS	PNS	PNS	PNS	PNS	ENS	PEW	EEW	PFIX
		ACI	2-31	$\overline{S12}$	S9	S9	S5	S5	S5	S5	S5
		T in ms	234	249.99	125.00	125.00	62.5	62.5	62.5	62.5	62.5
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	EVEN SUBFRAMES TELEMETRY WORDS 104,105								
J4502	ACC #3	DATA	PEW	PEW	PEW	ENS	PNS	ENS	PEW	EEW	PFIX
		ACI	2-31	$\overline{S12}$	S8.$\overline{S12}$	S8.$\overline{S12}$	S6	S6	S6	S6	S6
		T in ms	234	249.99	124.99	124.99	62.5	62.5	62.5	62.5	62.5
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	ODD SUBFRAMES TELEMETRY WORDS 49,50								
J4567	ACC #4	DATA	EEW	EEW	PEW	ENS	PNS	ENS	PEW	EEW	PFIX
		ACI	2-31	$\overline{S12}$	S9	S9	S7	S7	S7	S7	S7
		T in ms	234	249.99	125.00	125.00	62.5	62.5	62.5	62.5	62.5
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	EVEN SUBRAMES TELEMETRY WORDS 49,50								
J4503	ACC #5	DATA	PFIX	PFIX	PFIX	EEW	ENS	PNS	EEW	PEW	PNS
		ACI	2-16	S8.$\overline{S12}$	S8.$\overline{S12}$	S8.$\overline{S12}$	$\overline{S12}$	$\overline{S12}$	$\overline{S12}$	$\overline{S12}$	$\overline{S12}$
		T in ms	117	124.99	124.99	124.99	249.99	249.99	249.99	249.99	249.99
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	ODD SUBFRAMES TELEMETRY WORDS 51,52								
J4568	ACC #6	DATA	PFIX	PFIX	PFIX	EEW	PEW	EEW	PNS	ENS	PEW
		ACI	17-31	S9	S9	S9	$\overline{S12}$	$\overline{S12}$	$\overline{S12}$	S12	$\overline{S12}$
		T in ms	117	125	125	125	249.99	249.99	249.99	249.99	249.99
		XFR	S10	S10	S10	S10	S10	S10	S10	S10	S10
		RESET	S11	S11	S11	S11	S11	S11	S11	S11	S11
		READOUT	EVEN SUBFRAMES TELEMETRY WORDS 51,52								

A C C U M U L A T O R   G A T I N G
L O G I C   E Q U A T I O N S

May 19, 1976
E. W. Strein

1) X = (M3.PNS + M4.ENS + M5.PEW + M6.EEW + M7.PFIX)

2) Y = (M3.ENS + M4.PNS + M5.EEW + M6.PEW + M7.PNS)

3) Z = (M3.PEW + M4.EEW + M5.PNS + M6.ENS + M7.PEW)

4) ACC #1 = PNS.(S1.SCAN + $\overline{\text{S12}}$.M0.DWELL) + DWELL. [(M1 + M2).PNS.S8.$\overline{\text{S12}}$ + S4.$\overline{\text{S12}}$.(X)]

5) ACC #2 + ENS.(S1.SCAN + $\overline{\text{S12}}$.M0.DWELL) + DWELL. [(M1 + M2).PNS.S9 + S5.(X)]

6) ACC #3 = PEW.(S1.SCAN + $\overline{\text{S12}}$.M0.DWELL) + DWELL. [(M1.PEW + M2.ENS).S8.$\overline{\text{S12}}$ + S6.(X)]

7) ACC #4 = EEW.(S1.SCAN + $\overline{\text{S12}}$.M0.DWELL) + DWELL. [(M1.PEW + M2.ENS).S9 + S7.(X)]

8) ACC #5 = PFIX.(S2.SCAN + S8.$\overline{\text{S12}}$.M0.DWELL) + DWELL. [(M1.PFIX + M2.EEW).S8.$\overline{\text{S12}}$ + $\overline{\text{S12}}$.Y]

9) ACC #6 = PFIX.(S3.SCAN + S9.M0.DWELL) + DWELL. [(M1.PFIX + M2.EEW).S9 + $\overline{\text{S12}}$.Z]

Figure 2.6-1

Data Interpretation - The serial readout of ACC1-6 are assigned measurement numbers as follows:

ACCUMULATOR #	MEASUREMENT #
1	J4501
2	J4566
3	J4502
4	J4567
5	J4503
6	J4568

The bit assignment and interpretation of the above measurements are presented in the following three pages.

ACCUMULATOR 1

MEASUREMENT # J4501

EVEN MAIN FRAMES															
WORD 104								WORD 105							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC1-14	AC1-13	AC1-12	AC1-11	AC1-10	AC1-9	AC1-8	AC1-7	AC1-6	AC1-5	AC1-4	AC1-3	AC1-2	AC1-1	AC1-0	AC1-15

AC1-15 is the MSB of accumulator one (2^{15})

AC1-0 is the LSB of accumulator one (2^0)

To interpret J4501 as the number of counts stored in accumulator one, rotate J4501 right one bit. To obtain the following 16 bit number:

AC1-15	AC1-14	AC1-13	AC1-12	AC1-11	AC1-10	AC1-9	AC1-8	AC1-7	AC1-6	AC1-5	AC1-4	AC1-3	AC1-2	AC1-1	AC1-0

ACCUMULATOR 2

MEASUREMENT # J4566

ODD MAIN FRAMES															
WORD 104								WORD 105							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC2-14	AC2-13	AC2-12	AC2-11	AC2-10	AC2-9	AC2-8	AC2-7	AC2-6	AC2-5	AC2-4	AC2-3	AC2-2	AC2-1	AC2-0	AC2-15

AC2-15 is the MSB of accumulator two (2^{15})

AC2-0 is the LSB of accumulator two (2^0)

To interpret J4566 as the number of counts stored in accumulator two, rotate J4566 right one bit to obtain the following 16 bit number:

AC2-15	AC2-14	AC2-13	AC2-12	AC2-11	AC2-10	AC2-9	AC2-8	AC2-7	AC2-6	AC2-5	AC2-4	AC2-3	AC2-2	AC2-1	AC2-0

MEASUREMENT # J4502 ACCUMULATOR 3

EVEN MAIN FRAMES															
WORD 49								WORD 50							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC3-14	AC3-13	AC3-12	AC3-11	AC3-10	AC3-9	AC3-8	AC3-7	AC3-6	AC3-5	AC3-4	AC3-3	AC3-2	AC3-1	AC3-0	AC3-15

AC3-15 is the MSB of accumulator three (2^{15})

AC3-0 is the LSB of accumulator three (2^0)

To interpret J4502 as the number of counts stored in accumulator three rotate J4502 right one bit to obtain the following 16 bit number.

AC3-15	AC3-14	AC3-13	AC3-12	AC3-11	AC3-10	AC3-9	AC3-8	AC3-7	AC3-6	AC3-5	AC3-4	AC3-3	AC3-2	AC3-1	AC3-0

MEASUREMENT # J4567 ACCUMULATOR 4

ODD MAIN FRAMES															
WORD 49								WORD 50							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC4-14	AC4-13	AC4-12	AC4-11	AC4-10	AC4-9	AC4-8	AC4-7	AC4-6	AC4-5	AC4-4	AC4-3	AC4-2	AC4-1	AC4-0	AC4-15

AC4-15 is the MSB of accumulator four (2^{15})

AC4-0 is the LSB of accumulator four (2^0)

To interpret J4567 as the number of counts stored in accumulator four, rotate J4567 right one bit to obtain the following 16 bit number:

AC4-15	AC4-14	AC4-13	AC4-12	AC4-11	AC4-10	AC4-9	AC4-8	AC4-7	AC4-6	AC4-5	AC4-4	AC4-3	AC4-2	AC4-1	AC4-0

MEASUREMENT # J4503

ACCUMULATOR 5

EVEN MAIN FRAMES															
WORD 51								WORD 52							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC5-14	AC5-13	AC5-12	AC5-11	AC5-10	AC5-9	AC5-8	AC5-7	AC5-6	AC5-5	AC5-4	AC5-3	AC5-2	AC5-1	AC5-0	AC5-15

AC5-15 is the MSB of accumulator five (2^{15})

AC5-0 is the LSB of accumulator five (2^0)

To interpret J4503 as the number of counts stored in accumulator five, rotate J4503 right one bit to obtain the following 16 bit number.

AC5-15	AC5-14	AC5-13	AC5-12	AC5-11	AC5-10	AC5-9	AC5-8	AC5-7	AC5-6	AC5-5	AC5-4	AC5-3	AC5-2	AC5-1	AC5-0

MEASUREMENT # J4568

ACCUMULATOR 6

ODD MAIN FRAMES															
WORD 51								WORD 52							
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
AC6-14	AC6-13	AC6-12	AC6-11	AC6-10	AC6-9	AC6-8	AC6-7	AC6-6	AC6-5	AC6-4	AC6-3	AC6-2	AC6-1	AC6-0	AC6-1

AC6-15 is the MSB of accumulator six (2^{15})

AC6-0 is the LSB of accumulator six (2^0)

To interpret J4568 as the number of counts stored in accumulator six, rotate J4568 right one bit to obtain the following 16 bit number:

AC5-15	AC6-14	AC6-13	AC6-12	AC6-11	AC6-10	AC6-9	AC6-8	AC6-7	AC6-6	AC6-5	AC6-4	AC6-3	AC6-2	AC6-1	AC6-0

2.7 GEOMETRIC CONVERSION FACTOR

Based on geometric considerations and on preliminary comparisons with other experiments on ATS-6, the geometric factor (G) for ions is:

G = 16 * 10**(-4) cm cm ster

= (aperture area) * (aperture solid angle)

The value of G for electrons is one half of this, as one half of the electron aperture is covered to help prolong the sensor's life. This is necessary because the electron sensors are subject to much higher counting rates then the ion sensors.

The conversion factor (H), used in determining the differential energy flux, (where diff. E flux = cnt rate/H) is:

H = 3.2 * 10**(-4) cm cm ster ev/ev for ions.

Where:

H = G * Energy Bandwidth

= delta(A) * delta(Omega) * delta(E)/E

= G * 0.2

The H factor has energy dependent corrections at low energies due to:

1) The post analysis acceleration of particles which occurs between the lens and the spiraltron. This acceleration causes factors of three variations in H which occur gradually around 1-3 keV for ions and about 0.1-0.3 keV for electrons. There are also some changes when

the secondary suppressor is turned off. (the suppressor can be turned off between 0-100 eV on the high energy detector head, and between 0-22 eV on the low energy detector head)

2) The 0.1-0.2 volt noise level on the high energy analyzing plates and the 0.01-0.02 volt noise on the low energy plates. For the high energy analyzer, the plate noise becomes important below 5 ev., while for the low energy analyzer it is important below 0.1 ev.

H also has corrections in the electron data at higher energies due to the variations of the spiraltron efficiency with energy.

Figure (to be created) shows the results of the combined correction of H, Eff(lens) and Eff(spiraltron) on the raw count rate.

The mono-energetic angular resolution of the orthogonal planes of each detector is about 2.5 degrees for the narrow plane and 5 degrees for the wide plane. These angular resolutions spread by a factor of two for a full spectrum of energies.

3.0 DATA FORMATS & PROCESSING

3.1 SCATHA COMMON BLOCKS

CONTROLS AND FLAGS

COMMON/UNITS/ - Assigns logical devices to actual devices.

ITD = tape drive for input tape (MT2: or MT3:)

ITU = logical unit for tape

IOUT = logical unit for picture file on disk

LABEL = logical unit for label file on disk

IDEV = disk drive for picture and label files (DB1: or DB0:)

IPU = logical unit for lists of files one through four

COMMON/CALCE (CALculate ENergy) - Contains the M value and energy value for each .25 second time interval. M is the number of energy steps since the end of the last energy scan.

MVALUE = M value for each .25 second interval

EHIGH = NS detector temperature corrected energy value for each .25 seconds

ELOW = EW detector temperature corrected energy value for each .25 second.

M = current M value

PRSP = previous energy step

PRPRSP = previous, previous energy step

COMMON/OPCL/ (OPen, CLose)- Contains the information that routines SCOPEN and SCCLOS use to open and close disk files.

COMMON/TAPCOM/ - Contains the event flag and status words in which RTAPE (RTAPE is the routine which reads a given tape) returns the status of the tape read. (See COMMON/STATUS for more info. about status)

COMMON/BUFFER/ - Contains buffers where RTAPE puts the records from tape.

DATA

COMMON/COUNTS/ - Contains the raw counts and accumulator gatings. In NORMAL MODE of operations, the accumulator assignments are:

IACC1 = NS Ions (sampled every .25 second)

IACC2 = NS Electrons (sampled every .25 second)

IACC3 = EW Ions (sampled every .25 second)

IACC4 = EW Electrons (sampled every .25 second)

IACC5 = Fixed Ions (sampled every .125 second)

IAG = Accumulator gating

NOTE: IACC does not equal the variable ACCX found in subroutine CTRT. see COMMON/CTRT/ for more information on IACC and ACCX.

UN-NORMAL MODES - Each of the accumlators can be used to sample different directions and particles than it normally does. This enables one particular form of data to be sampled more often. These un-normal modes occur only during dwell cycles, not during scan. See page 70 of the current SC-9 Handbook for a listing of all modes and their commands.

COMMON/CTRT/ (CounT RaTe) - Contains the count rate (counts per second) as generated by CRATE. (CRATE computes dead-time, background and bias corrected count rates)

NOTE: Raw data from the tape is put into integer variables IACC1-5. These raw counts are then converted by CRATE into floating point count rates and put into variables ACC1-5. Then, in order to list the count rates without a decimal they are converted to double precision integer format and put into variables DACC1-5. DACC1-5 are equivalenced to ACC1-5 in subroutine PRPROC.

ACCX = counts per second in Real format

DACCX = counts per second in Integer format

COMMON/DISTRB/ - Contains the calculated distribution functions for the

five detectors.

DFNSEL = Distribution Function, NS Electrons

DFNSIO = Distribution Function, NS Ions

DFEWEL = Distribution Function, EW Electrons

DFEWIO = Distribution Function, EW Ions

DFFXIO = Distribution Function, Fixed Ions

COMMON/MAG/ - Contains the raw Magnetometer data. X,Y,Z coarse and fine values and the direction of the X,Y, Z vectors.

COMMON/MAGCS/ - Contains the X,Y and Z coordinates of the Magnetic Field in the Magnetometer's coordinate system. It also contains the magnitude of .he total vector and of the vector in the X,Y plane.

MAGX = X component of magnetic field

MAGY = Y component of magnetic field

MAGZ = Z component of magnetic field

MAGTOT = magnitude of the total X,Y,Z vector

MAGPER = magnitude of the X,Y vector (this is the plane perpendicular to the spin axis)

COMMON/ROTATE/ - Contains rotational information.

NSP = NS detector analog position

IEWP = EW detector analog position

NSPC = NS detector position counter

IEWPC= EW detector position counter

ICWNS = counter clockwise NS detector. It equals 1 if
NS detector moving CCW, equals 0 if moving CW.

ICWEW = counter clockwise EW detector. It equals 1 if
EW detector moving CCW, equals 0 if moving CW.

NSLL = NS detector position lower limit (validity of data
not yet checked)

NSUL = NS detector position upper limit (validity of data
received not yet checked)

IEWLL = EW detector position lower limit (validity of data
received not yet checked)

IEWUL = EW detector position upper limit (validity of data
received not yet checked)

NSPS = NS detector park, sweep wag (validity of data
received not yet checked)

IEWPS = EW detector park, sweep wag (validity of data
received not yet checked)

COMMON/PROBEV/ - contains probe voltages from SC-2 experiment. (validity of data received not yet determined)

COMMON/SC10/ - Contains field data from SC10 experiment. (validity of data received not yet checked)

IEC1-4 = electric channels 1-4

IMC1-4 = magnetic channels 1-4

IPCV = + calibration verification

INCV = - calibration verfication

MCNV = magnetometer common mode

MODE = mode

COMMON/SC4E - Contains electron gun data from SC-4 experiment. Validity of dat checked by R.C.O. 1980. (See COMMON/SC4I/ for more information)

IBCF = beam current flags 1-5

IBON = beam on/off

IBDCF = beam duty cycle flag

IBFF1-2 = beam focus flags 1-2

IBCH = beam current high

IHVM = high voltage monitor

IBEF = beam energy flags 1-4

IVM1-2 = voltage monitor 1-2

COMMON/SC4I/ - Contains ion gun data from SC-4 experiment. Validity of data checked by R.C.O. 1980. (See COMMON/SC4E for more information)

IBCM = beam current monitor

NE = neutralizer emmission

ISNCM = satellite positive ion system (SPIBS) net current monitor

IDCUR = discharge current

IBVM = beam voltage monitor

KCM = keeper current monitor

KHVM = keeper high voltage monitor

IACM = accelator current monitor

IDCM = decelerator current monitor

NHCM = neutralizer htr current monitor

NBVM = neutralizer bias voltage monitor

COMMON/SOLAR/ - Contains solar array currents. Validity of data checked by R.C.O. 1980.

OMMON/TIMEN/ - Contains time and the variables to be used in energy calculations.

IGT = ground time in milliseconds

IDC = deflection control counter (energy step number)

ITNS = temperature NS detector head

ITEW = temperature EW detector head

ITMB = temperature of Motor Box

ITPCU = temperature of Power Cond. unit

IMP = motor power

NOTE: The validity of the data contained in the following variables

has not yet been determined.

IDN = number of dwells per cycle

ID1 = initial dwell step

IDT = dwell time

IDS = dwell step size

COMMON/STATUS/ - Contains the status of Latching and Magnitude commands. For a description of the Latching commands see page 16 of the current SC-9 Handbook. (see page 14 for spiraltron bias voltage) The last command sent to the instrument is used to determine its status.

LC1 = status Latching commands 1-7. These give status of commands 7002-7020.

LC2 = status Latching commands 8-14. These give status of commands 7021-7041.

MC1 = status of the Magnitude commands 1-8. Magnitude commands start with command number 7100.

MC2 = status of the Magnitude commands 8-14. Magnitude commands start with command number 7100.

COMMON/SUBCID/ - contains the subcommand Id, one byte for each eighth of a second.

COMMON/VOLT/ - Contains deflection and spiraltron voltages. The selected energy step equals a fudge factor multiplied by the deflection voltage.

IDV(1) = + deflection voltage NS detector

IDV(3) = + deflection voltage EW detector

IDV(5) = + deflection voltage Fixed detector

IDV(2) = - deflection voltage NS detector

IDV(4) = - deflection voltage EW detector

IDV(6) = - deflection voltage Fixed detector

NOTE: The above variables contain the true voltage on the spiraltron assembly plates. They are outputted every 16 seconds and can be used to check the C1 Correction. One voltage variable is for the top plate of the spiraltron assembly and the other is for the bottom plate.

ISV(1) = spiraltron voltage NS detector

ISV(2) = spiraltron voltage EW detector

ISV(3) = spiraltron voltage Fixed detector

ORBIT ATTITUDE DATA

COMMON/PITCHA/ - Contains pitch angle information.

PAFXD = Fixed detector pitch angle computed every .25 second

PAEWD = EW detector pitch angle computed every .25 second

PANSD = NS detector pitch angle computed every .25 second

NOTE: The following variables are computed every second.

LVSNSX = look vector, space craft frame, NS detector, X coordinate

LVSNSY = look vector, space craft frame, NS detector, Y coordinate

LVSEWX = look vector, space craft frame, EW detector, X coordinate

LVSEWY = look vector, space craft frame, EW detector, Y coordinate

LVSEWZ = look vector, space craft frame, EW detector, Z coordinate

LVSFXX = look vector, space craft frame, Fixed detec, X coordinate

LVSFXY = look vector, space craft frame, Fixed detec, Y coordinate

LVSFXZ = look vector, space craft frame, Fixed detec, Z coordinate

DANS = detector angle, NS detector

DAEW = detector angle, EW detector

COMMON/EPHEM/ - Contains values found in the ephermeris file. The following values are taken every hour, 0-24, from the ephemeris file in subroutine F4PROC and are used in SCLABL.

RADIUS = radius in earth radii

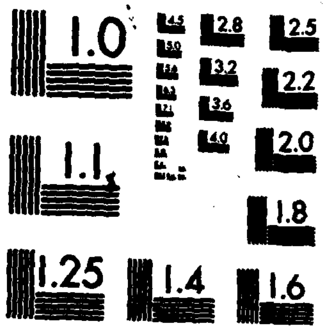
LOCTIM = local time

MAGLAT = magnetic latitude

AD-A129 297 HANDBOOK FOR UCSD SC9 SCATHA AURORAL PARTICLES EXPERIMENT(U) CALIFORNIA UNIV SAN DIEGO LA JOLLA SPACE PHYSICS LAB S DEFOREST ET AL. AUG 80 F04701-77-C-0062

2/3

UNCLASSIFIED F/G 22/1 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

3.2 SC9 TAPE LISTING

The tape listing gives day, year, time, particle count rates, magnitude of the magnetic field vectors, detector position, computed distribution functions, detector pitch angles, detector energy and the energy step number. Figure (to be created) shows a typical output page. At the top of the listing is the year, day, start and end time of the listing and the day the listing was created. The Ground time in seconds, and in hours, minutes and seconds is outputted every 16 seconds. The variable SUBCOMID (TBD) is also given every 16 seconds. So far it has always been set equal to zero.

Count rates are given for the High Energy Detectors (NS and Fixed) and for the Low Energy Detector (EW). The accumulator assignments when in scan mode are:

ACC1 = NS Ions

ACC2 = NS Electrons

ACC3 = EW Ions

ACC4 = EW Electrons

ACC5 and ACC6 = Fixed Detector (two readings per 1/4 second)

Nominally, these accumulator assignments are the same during a dwell period. However, as each accumulator can be used to sample different directions and particles than normally assigned to them, there are eight different accumulator assignment modes available. Examples

of these modes are: Fast Ion, Super Fast Ion, etc... (see page 48 for the current SC-9 Handbook for a table of all modes and their commands)

The energies of the High Energy and Low Energy Detectors are given in eV. The High Energy values are not given until after the first dwell period of the listing. This is because the High Energy values must have the C1 energy correction, which is dependent upon M. As M is the number of steps since the last dwell, one dwell must occur before the C1 corrected High Energy values can be determined.

The distribution function in (sec**3) * (KM**-6) is given. As above, the values for the High Energy Detectors are not given until after the first dwell period.

LIST OF VARIABLES

IDC = Energy step number

MAGTOT = magnitude of the total magnetic field vector

MAGX = magnitude of the X component of the magnetic field

MAGY = magnitude of the Y component of the magnetic field

MAGZ = magnitude of the Z component of the magnetic field

HIPC = high energy head position counter

HIP = high energy head position (voltage)

LOPL = low energy head position counter

LOP = low energy head position (voltage)

PAHI = pitch angle high energy detector (NS Detector)

PALO = pitch angle low energy detector (EW Detector)

PAFXD = pitch angle fixed detector

NOTE: The pitch angle is defined as the angle between the particle velocity vector and the mangetic field direction. (see figure (to be created)) The particle velocity direction is 180 degrees to the look direction of the detector. A negative direction is given when the detector is looking to the earthward side of the magnetic field line.

M = number of energy steps since last dwell

3.3 SPECTROGRAM DESCRIPTION

Spectrograms give a grey scale representation of the detector count rates with lightness, or intensity, as a function of the count rate. The two axes used on the spectrogram are energy versus time. Presently, the magnitude of the total magnetic field vector is plotted along the top of each spectrogram. Any or all of the five detectors can be placed on the same spectrogram. The user also has the option of selecting the pitch angles for which he wants the data to be displayed. (include several spectrograms here as examples)

AXES LABELING

The energy axis on the sides of a spectrogram is a combination of linear and then logarithmic scales. For the High Energy detector, the scale is linear from 0-10 eV and logarithmic from 10 eV to 80 keV. The Low Energy detector scale is linear from 0-0.2 eV and logarithmic from 0.2-1700 eV. The time axis on the bottom is in universal time, and usually specifies hours and minutes.

INTENSITY

The intensity scale of the spectrograms runs from 0-31. (integer

values) The raw counts are converted to this scale through the use of a table of conversion values. To develope this table, the biased log of the raw count rate is computed for a specified value of bias and background subtraction. Biased log(cnt rate) =

999.9 * log10[(DTCR - background) + Bias]

Where DTCR = Deadtime corrected count rate. (Default value for deadtime is 3.5 E-6 sec. This value can be changed in ACCESS)

NOTE: If (DTCR - Background) is negative, the Biased log(cnt rate) is set equal to 900. (this value can be changed in ACCESS) Also, if the background subtraction is absent, it is taken to be zero. Because of the way the program Blog (it computes the biased log) handles a bit shift, the background must be an even number. If it is not, the spectrogram program makes it so.

This biased log, computed once for the ions and once for the electrons, is then used to set up the intensity conversion table. The conversion table is also dependent upon the specified contrast.

If the converted raw counts are too large for the intensity scale, the user can either have the scale cycle or saturate at maximum intensity. In the cycle mode, the intensity reaches maximum lightness, then recycles back to black to start over again.

Figures (3.3-1 and 3.3-2) are two plots which show how the curve of the Intensity versus the Biases log(cnt rate) varies as one changes

either the bias or the contrast (CF). Varying the bias causes the curve to shift its starting point, while varying the contrast changes the slope of the curve.

MAGNITUDE OF MAGNETIC FIELD PLOTS

The magnitude of the total magnetic field vector is plotted on a 0-100 gamma scale. If the magnitude exceeds 100 gamma, the scale cycles, becomming a 100-200 gamma scale. This continues as long as ncessary in 100 gamma cycles.

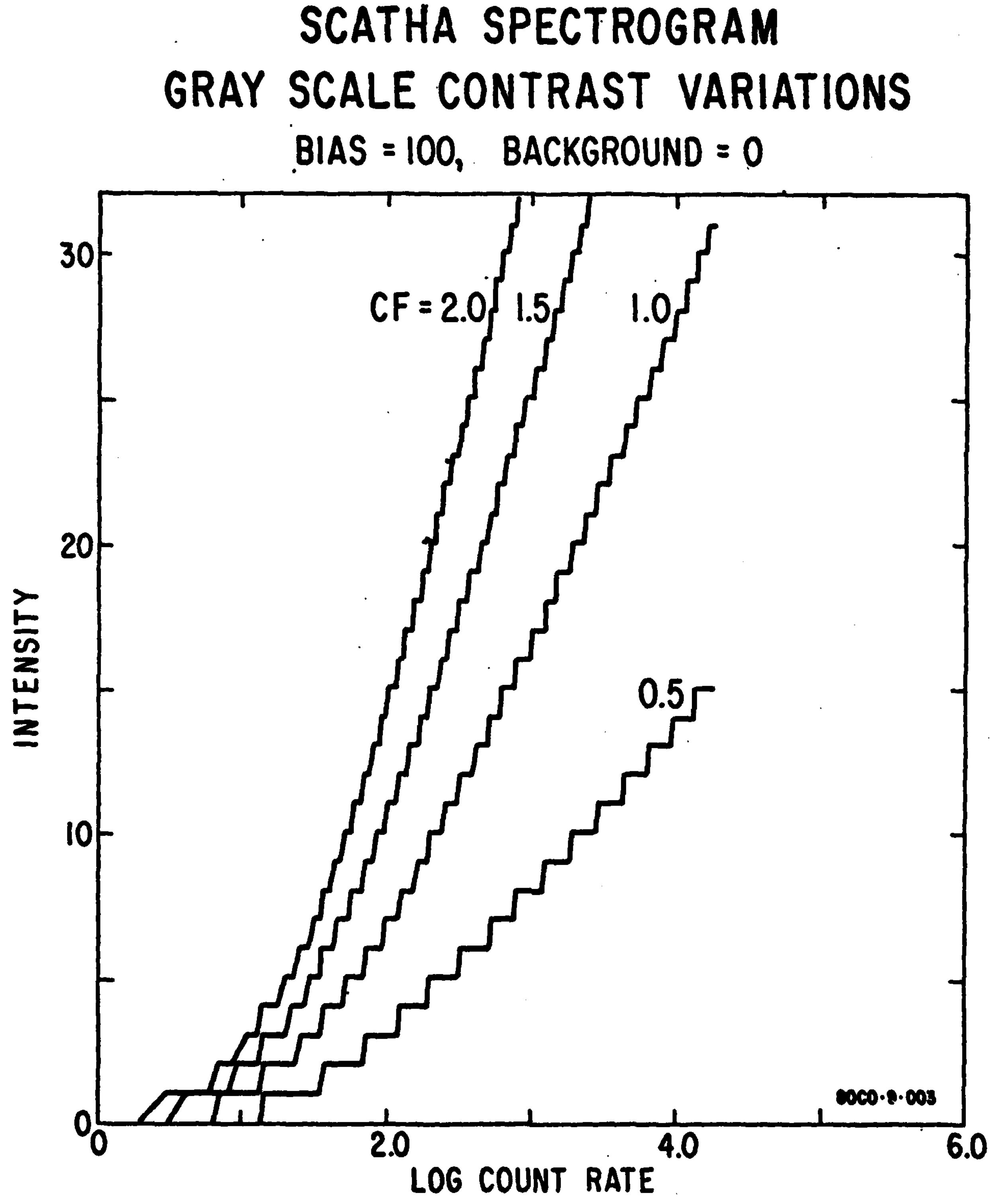

SCATHA SPECTROGRAM
GRAY SCALE CONTRAST VARIATIONS
BIAS = 100, BACKGROUND = 0
INTENSITY
LOG COUNT RATE
CF = 2.0
1.5
1.0
0.5
0
10
20
30
2.0
4.0
6.0
80C0-9-003

Figure 3.3-1

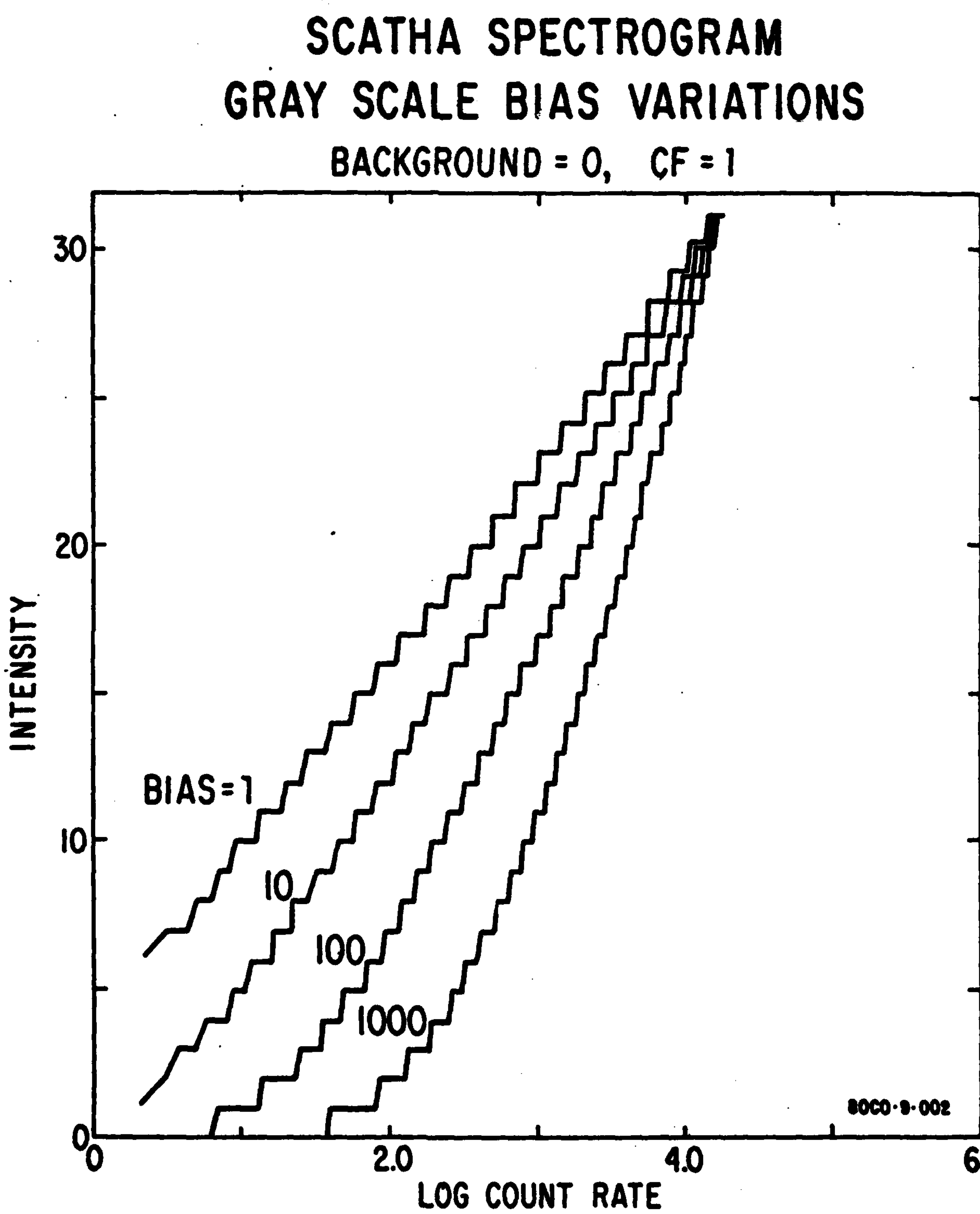

SCATHA SPECTROGRAM
GRAY SCALE BIAS VARIATIONS
BACKGROUND = 0, CF = 1
30
20
10
0
INTENSITY
BIAS=1
10
100
1000
80C0-9-002
0
2.0
4.0
6.0
LOG COUNT RATE

Figure 3.3-2

APPENDIX 1

AFG1 ELECTRON AND ION GUN EXPERIMENT (SC4)

APPENDIX 1 SC4 DOCUMENTATION

AFG1 ELECTRON AND ION GUN EXPERIMENT (SC4)

SC4 is the AFGL electron(-1) and ion(-2) gun experiment. Sufficient telemetry should be available to enable SC9 experimenters to determine the instrumental mode, and to understand the resulting potential fluctuations.

SC4-1

The electron gun operates in an uncomplicated fashion, simply ejecting electrons at the specified current and voltage. Substantial positive potential excursions have been caused, up to the beam potential. More frequently, the ambient low energy electron flux appears to be suffiecient to balance the beam current at positive spacecraft potentials below the magnitude of the beam potential.

The common block containing this information is SC4E.

```
COMMON /SC4E/ CONTAINS ELECTRON GUN DATA FROM SC-4 EXPERIMENT
      COMMON/SC4E/IBCF(5,8),IBON(8),IBDCF(8),IBFF1(8),IBFF2(8),IBEF(4,
),
      1       IBCH(16),IHVM,IVM1,IVM2
      BYTE IBCF,IBON,IBDCF,IBFF1,IBFF2,IBEF
C
C     IBCF=BEAM CURRENT FLAGS 1-5     IBON=BEAM ON/OFF
C     IBDCF=BEAM DUTY CYCLE FLAG      IBFF1-2=BEAM FOCUS FLAGS 1-2
C     IBEF=BEAM ENERGY FLAGS 1-4
C     IBCH=BEAM CURRENT HI
C     IHVM=HIGH VOLTAGE MONITOR
C     IVM1-2=VOLTAGE MONITOR 1-2
C
```

The data are to be interpreted with the following tables:

Beam Current Flag (IBCF)

01111	13.0 ma
10111	6.0 ma
11011	1.0 ma
11101	0.1 ma
11110	0.01 ma
11111	0.001 ma

Beam Energy Flags

1100	3 kv
1100	3.00 kv
100	1.50 kv

0000	0.50 kv
0010	0.30 kv
0001	0.15 kv
0011	0.05 kv

Beam On Off Flag

1	on
0	off

Duty Cycle Flag

1	100%
0	6.25% (inoperable after day 89, 1979)

Focus Flags

00	hi
10	medium
01	low
11	not allowed

Cap Flag

1	cap on
0	cap off (not valid)

Beam Current (IBCH)

IBCH should be multiplied by .02 to obtain the telemetry voltage in volts. Four volts is full scale. The scale changes with the selected voltage, so IBCH=200 implies the selected current (IBCF) is being emitted.

SC4-2

The ion gun is more complicated than the electron gun in operational modes and in data interpretation. In particular, the telemetry values are non-linear functions of the instrumental voltages and currents. Graphs for each value are included. In each case the earth Telemetry values (E T/M, V) on the graphs are .02 times the integer telemetry value found on the tape.

The ion gun parameters are found in common block SC4I. They are interpreted as follows:

```
C COMMON /SC4I/ CONTAINS ION GUN DATA FROM SC-4 EXPERIMENT
      COMMON/SC4I/IBCM(16),NE(16),ISNCM(16),IDCUR(8),
     1        IBVM,KCM,KHVM,IACM,IDCM,NHCM,NBVM,NBPF(8)
      BYTE NBPF
C
C     IBCM=BEAM CURRENT MONITOR
C     NE=NEUTRALIZER EMISSION         ISNCM=SPIBS NET CURRENT MONITOR
C     IDCUR=DISCHARGE CURRENT
C     IBVM=BEAM VOLTAGE MONITOR
C     KCM=KEEPER CURRENT MONITOR      KHVM=KEEPER HIGH VOLTAGE
C     IACM=ACCELERATOR CURRENT MTR    IDCM=DECELERATOR CURRENT MONITOR
C     NHCM=NEUT HTR CURRENT MONITOR   NBVM=NEUT BIAS VOLTAGE MONITOR
```

The beam voltage (IBVM) generally equals the set value, but the telemetry wanders as the beam current varies. The beam current telemetry (IBCM) is correct. The keeper current (KCM) may have an offset, and may vary as the beam setting is varied or with time.

Note that the neutralizer emission current (NE) and the net current (ISNCM) have a sign associated with them, and 2.5 volts (125 counts) corresponds to zero current.

APPENDIX 2

SC10 ELECTRIC FIELD MONITOR

APPENDIX 2

DESCRIPTION SC10

SC10 ELECTRIC FIELD MONITOR

The instrument is a NASA-supplied double floating ensemble consisting of three payload packages: SC10-1 is the internal electronics mechanism. SC10-2 is a 50-meter long, 1/4 inch in diameter, extendable antenna located on the Spacecraft at 236 degrees. It is often noted as the +Y Antenna. SC10-3 is also a 50-meter long extendable antenna and it is located at 56 degrees. It is often noted as the -Y Antenna.

The inner 30 meter section of the two booms are coated with Kapton insulation to move the outer 20 meter active probe areas away from the plasma sheath of the Spacecraft as this can overlap with the ambient plasma and contaminate probe measurements. When fully deployed, the two antennas will form a 100 meter (end to end) dipole. The instrument detects DC Electric Field strengths in the range of 0.1 to 20 mV/m and AC Fields of 1 to 100 micro V/m at frequencies between 3 and 10 Hz.

The probe on the end of each antenna will be used to measure AC and DC Electric Fields as a Common Mode Voltage and as a Differential Voltage. In the Common Mode, each antenna will be used seperately to measure the Space Craft potential by measuring the absolute potential between the Space Craft and the ambient plasma. This signal will monitor Spacecraft charging events. For the Differential signal, the potential induced between the dipole pair of probes is measured in order to determine the Electric Fields in the ambient plasma.

The 100 meter dipole antenna is also shared by the SC1-7 and SC1-8 experiments. In addition, one of the Fourier digitized waveform analizers can be ordered to detect the signal of the X component of the SC11 magnetometer experiment. (This data is received in the telemetry words K4012 - K4015. Word K2003 signifies which instrument is being monitored.) When operating in the Magnetic Field Mode, morphological data realtive to the E and B noise at the orbit of the Spacecraft will be obtained. (From "Description of Space Test Program P78-2, Spacecraft and Payloads" page 53; "Telemetry Requirements Docquement, page 2.11-11; and the "Orbital Requirements Docquement, Volume 1)

OPERATIONAL ASPECTS

The extension of the two antennas was not begun until several weeks after the satelite's insertion into orbit. This was to allow the other experiments (which are sensitive to the Satillite's plasma sheath) a base line period without the interference created by the two long floating probes. The antennas were then deployed in three stages in order to study the probe characterisitics of the antennas with varying degrees of overlap from the Spacecraft's plasma sheath. The boom

was extended to 10 meters on day 56, and was extended to its full lenght on day 68. (added 7-30-80 S.J.) The antennas have space brush material in the deployment motors to allow additional changes in the antennas' length once they have been fully deployed. However, the antennas will probably be kept at their full deployment of 100 meters for the lifetime of the satillite. (From "Description of Space Test Program P78-2, Spacecraft and Payloads", page 55)

SCIENTIFIC OBJECTIVES

The SC10 Electric Field Monitor will be used to observe the steady state convectional Electric Fields that are known to exist at the Spacecraft's orbit. The instrument will also measure Electric Fields resulting from transient events such as electrostatic discharge on selected Spacecraft insulating surfaces and to monitor Space Vehicle charging. Data from the instrument will be used to correlate data from the other engineering experiments on the satillite and, along with the SC1 Antennas, to characterize electromagnetic interference in the vicinity of the Spacecraft.

TELEMETRY SPECIFICATIONS

Data from SC10 is telemetered in three different formats: 1) Directly in digitized waveform; 2) in the Fourier Domain using digitized Fourier analyzed wave; 3) and in Real Time. (NOTE: UCSD receives only the Fourier digitized waveform) The SC10-3 Antenna (-Y Axis) is measured directly in the Common Mode using three different voltage ranges: -15 V, -300 V and -5,000 V. The SC10-2 Antenna (+Y Axis) is also measured directly in the Common Mode, but with only one voltage range of +15 V. (This favoring of the negative axis is due to the fact that the potential of the Spacecraft with respect to the probes is usually negative. This negative relative potential is caused by which the different materials the Spacecraft and probes are constructed of.)

The Differential signal between the two antennas is also monitored directly with several voltage gains which appear as DC Low (x 0.025), DC High (x 0.25), and AC (x 2.5) in the telemetry data. Both the Common Mode signal and the Differential signal are monitored in the Fourier Domain as RMS signals in four frequency bands which vary from 0.1 to 2000 Hz.

For the Real Time mode, a wide band FM-FM Link is available on command only for the Differential signal. This format is planned for operations up to three hr/day in order to cover a number of different Local Time Regions. The following table describes the three different formats.

FORMAT	COMMOM MODE		DIFFERENTIAL MODE	
Direct	Ranges:	a) +/- 15 V	Gains:	a) X 0.025
		b) -300 V		b) X 0.25
		c) -5,000 V		c) X 2.5
Fourier	Freq. Bands:	a) 0.1 to 1 Hz	Freq. Bands:	a) 0.1 to 1 Hz
		b) 1 to 2 Hz		b) 1 to 2 Hz
		c) 2 to 20 Hz		c) 2 to 20 Hz
		d) 20 to 2000 Hz		d) 20 to 200 Hz
Real Time	Not Telemetered		DC to 200 Hz V.C.O.	

DESCRIPTION OF TELEMETRY WORDS

K2001 - Calibration Verification of SC10-2 Antenna, Range: 0 - 5 Volts DC
K2002 - Calibration Verification of SC10-3 Antenna, Range: 0 - 5 Volts DC
K2003 - Magnetic/Common Mode Verification (signifies if the received output is from the SC10 Spectometer or from the X Axis of the SC11 Magnetometer)
K2004 - Mode
K2005 - Full Extension of SC10-2 Antenna
K2006 - Full Retraction of SC10-2 Antenna
K2007 - Full Extension of SC10-3 Antenna
K2008 - Full Retraction of SC10-3 Antenna

The following words must be converted to Volts DC using the equation: Volts= 0.020 * (measurement) Volts DC
The Range of these words is 0 - 5.1 Volts DC.

K4001 - DC High (For Direct Format of Differential signal)
K4002 - DC Low (For Direct Format of Differential signal)
K4003 - AC (For Direct Format of Differential signal)
K4004 - Common Mode 1 (-) (For Direct Format of SC10-3 Antenna, DC Low)
K4005 - common Mode 2 (-) (For DireCt Format of SC10-3 Antenna, DC High)
K4006 - Common Mode 3 (-) (For Direct Format of SC10-3 Antenna, AC)
K4007 - Common Mode 1 (+) (For Direct Format of SC10-2 Antenna, DC Low)
K4008 - Electric Channel 1, Frequency band from 0.1 to 1.0 Hz (For Fourier Format of Differential signal)
K4009 - Electric Channel 2, Frequency band from 1 to 2 Hz) (For Fourier Format of Differential signal)
K4010 - Electric Channel 3, Frequency band from 2 to 20 Hz (For Fourier Format of Differential signal)
K4011 - Electric Channel 4, Frequency band 20 to 200 Hz (For Fourier Format of Differential signal)

The next four words contain either the signal from the Fourier Format of the Common Mode or the output from the X Axis of the SC11 Magnetometer (in solar magnetospheric coordinates). See either the

constant "MV" or the word K2003 to determine which output is being monitored.
K4012 - Magnetic Channel 1 (Frequency Band from 0.1 to 1.0 Hz)
K4013 - Magnetic Channel 2 (Frequency Band from 1 to 2 Hz)
K4014 - Magnetic Channel 3 (Frequency Band from 2 to 20 Hz)
K2015 - Magnetic Channel 4 (Frequency Band from 20 to 200 Hz)
K4018 - Length Pot(-) (For determening the length of the extendable SC10-3Antenna)
K4019 - Length Pot(+) (For determening the length of the extendable SC10-2Antenna)

The following words are not to be converted to Volts DC.

K4016 - Motor temperature of Sc10-2 Antenna
K4017 - Motor Temperature of SC10-3 Antenna
(K4016 and K4017 should be converted to degrees Centigrade by a TBD equation (equation 4.7.13-1))
K6001 - Broadband Electric Field (BEF) Sources

DEFINITION OF CONSTANTS

EX (Extension): EX will equal either "+E" or " ", depending upon whether word K2005 equals one or zero. EX will also equal either "-E" or " ", depending upon whether word K2007 equals one or zero.

RE (Retraction): RE will equal either "+R" or " ", depending upon whether word K2006 equals one or zero. RE will also equal either "-R" or " ", depending upon whether word K2008 equals one or zero.

DAT (Data(?)): DAT will equal either "+CL" "+SG", depending upon whether word K2001 equals one or zero. DAT will also equal either "-CL" or "-SG" depending upon whether word K2002 equals one or zero.

MV (Magnetic): MV will equal either "MG" (magnetic) or "CM", (Common Mode) depending upon whether word K2003 equals one or zero.

MODE: MODE equals either "ON" or "OFF", depending upon whether word K2004 equals one or zero.

SYST = System Time in integer seconds.
VTCW = Vehicle Time Code Word in integer seconds (from same Main Frame as DC High)
FRM = Frame Count from T8300 in same Main Frame as VTCW
SANG = Angle in degrees (0 - 360) between SC10-2 Antenna (+Y Axis) and

the plane defined by Space Vehicle spin axis and the sun Space Vehicle

line at time of sampling K4001. (The position of the +Y Antenna should be calculated to an accuracy of one degree with respect to the sun at time of measurement group reading)

APPENDIX 3

SC11 MAGNETIC FIELD MONITOR

APPENDIX 3 SC11 MAGNETIC FIELD MONITOR

DESCRIPTION

The SC11 Magnetic Field Monitor is a tri-axial fluxgate magnetometer with its sensors located on the end of a four meter long boom. The boom is along the spacecraft's negative Y axis (270 degrees) and the three sensor heads are accurately aligned with the corresponding spacecraft axes with one axis parallel to the satillite's spin axis. Each axis sensor consists of a high permeability core which is magnetized to saturation by a solenoid and an AC generator. The outputs of each sensor is biased by 2.5 volts to give each sensor the range of -700 gamma to +700 gamma in measuring the magnetic flux density.

An error analysis by the spacecraft's manufacturer extimates that the absolute accuracy of the measurements of the ambient field along the space vehicle's X axis will be better than one gamma at one sigma confidence level. Errors in the Y and Z axes will be even less than in the X axis. (From: Telemetry Requirements Document, page 67)

The instruments booms were deployed on 2-22-79. (day 53) The magnetometer was also checked out on this day. It began taking data on day 54.

The spacecraft's spin enables the small magnetic field (a few tenths of a nano tesla) due to the spacecraft and any stray remanent fields at the location of the magnetometer to be corrected for in the Y and Z axes. Calibration of the field in the X direction will hopefully be obtained from comparisons between the data obtained from SC11 and data from the UCSD Auroral Particles Experiment. (one nano tesla = one gamma = one milligauss)

SCIENTIFIC OBJECTIVES

The data from SC11 will be used to determine the magnitude and orientation of the magnetic field in the instrument's sensor coordinates. This information will be used to correlate results from all of the charged partical dectors with the earth's magnetic field and to analyze the field aligned and distributed current systems in the region around synchronous altitude. The information will also be used to study the magnetosphere dynamics as it effects spacecraft charging. (From: "Description of the Space Test Program P78-2 Spacecraft and Payloads" 31 October, 1978; section 18, page 56 and the Telemetry Requirements Document, (TRD), section 3.5)

MAGNETIC FIELD CALCULATIONS

The procedure for converting the analog outputs from the instrument's three sensors into the X,Y and Z components of the magnetic

field is as follows:

High resolution data from measurements L4001 thru L4006 and measurement L4010 will be used to compute the X,Y and Z components of the magnetic field in the magnetometer's coordinates using a least square fit for each 15 second segment of data as follows:

$$Bx = Ax * [F(Vxc) + (Vxf - 0.473)/Gx - Vox] + Cx + Kx(W)$$
$$By = Ay * [F(Vyc) + (Vyf - 0.474)/Gy - Voy] + Cy + Ky(W)$$
$$Bz = Az * [F(Vzc) + (Vzf - 0.477)/Gz - Voz] + Cz + Kz(W)$$

WHERE:

Vxc= L4001 converted to volts
Vyc= L4003 converted to volts
Vzc= L4005 converted to volts

Vxf= L4002 converted to volts
Vyf= L4004 converted to volts
Vzf= L4006 converted to volts
Volts= 0.020 * (Decimal representation of L40XX)

F(Vxc),F(Vyc) and F(Vzc) are found from the following table:

Vxc,Vyc or Vzc	F(Vxc)	F(Vyc)	F(Vzc)
0.00 - 0.15	-0.0014	-0.0016	-0.0014
0.16 - 0.47	0.3111	0.3109	0.3111
0.48 - 0.78	0.6235	0.6235	0.6233
0.79 - 1.09	0.9362	0.9362	0.9360
1.10 - 1.41	1.2486	1.2483	1.2491
1.41 - 1.72	1.5613	1.5610	1.5618
1.73 - 2.03	1.8738	1.8737	1.8741
2.04 - 2.34	2.1865	2.1864	2.1869
2.35 - 2.65	2.5001	2.4995	2.4994
2.66 - 2.96	2.8128	2.8122	2.8121
2.97 - 3.28	3.1253	3.1250	3.1244
3.29 - 3.59	3.4380	3.4377	3.4372
3.60 - 3.90	3.7505	3.7498	3.7503
3.91 - 4.21	4.0632	4.0625	4.0631
4.22 - 4.52	4.3758	4.3754	4.3754
4.53 - 4.84	4.6886	4.6882	4.6882

(These are the revised values of F(Vxc), F(Vyc) and F(Vzc) as of 7-13-79 obtained through private correspondence with the experimentor.)

Ax= 192.58
Ay= 192.37
Az= 192.72

Kx(W),Ky(W) and Kz(W) are temperature correction factors using an interpolation table for each Kx, Ky or Kz. W is a thermister output and is the word L4010 converted to volts. For all values of W, Kx(W) and Kz(W) equal zero. The value of Ky(W) is to be found by linear interpolation between the following points:

W (Volts)	Ky(W) (Gamma)
0.0	0.0
3.7	0.0
4.8	0.8
5.1	1.02

(There is a discrepancy between the TRD and the Orbital Requirements Document (ORD) as to which functions equaled zero and which needed the interpolation table. According to the experimentor, the TRD is correct and Ky(W) needs the table.)

Gx= 12.991
Gy= 12.991
Gz= 12.991

Vox= 2.491
Voy= 2.513
voz= 2.499

Cx,Cy, and Cz are the correction for the spacecraft field for each axis and may require modification after more data has been obtained. The values given are those received from the experimentor as of 7-13-79. In the first three months, samll fluctuations were seen by the expermenor in either the instrument zero or the spacecraft fields. The Y component has varied from -0.5 to +0.6 gamma, and probably cannot be corrected for general production runs. The Z component has ranged from -0.8 to -0.3 gamma, and Cz has been set at -0.5 gamma. The correction in the X field remains to be determined from comparisons between data obtained from the magnetometer and the UCSD Auroral Particles Experiment.

Cx= 0.0
Cy= 0.0

Cz= 0.5

These values of Bx,By and Bz shall be converted from sensor coordinates to the spinning space vehicle reference coordinates using:

Bs = R * B

where R is the appropriate transform matrix determined from SC11 boom alignment measurements.

$$[R] = \begin{matrix} .99980 & .01390 & .01304 \\ -.01307 & .99990 & .00209 \\ -.01307 & .00227 & .99991 \end{matrix}$$

(This matrix was received from the experimentor on 7-13-79)

The X, Y, and Z components of the magnetic field shall be converted from the spinning space vehicle coordinates into a non-spinning cartesian coordinate system (despun axis) using the following equation:

Bd= N * Bs

Where N is the appropriate matrix descrived as follows:

$$[N]= \begin{matrix} 1 & 0 & 0 \\ 0 & \cos(\text{Alpha}) & \cos(\text{Alpha}) \\ 0 & -\sin(\text{Alpha}) & \cos(\text{Alpha}) \end{matrix}$$

Where:

Alpha = w * 0.75 degrees

w is the spin rate in rpm about the plus X axis.

This relationship is accurate for 3 >w> 0.5.

Because the spacecraft is precessing about the Z axis, one also needs to obtain the direction of the angular momentum vector from SAMTEC in order to compute the Despun Coordinate System more accurately. (The above algorithim for computing the various coordinate systems from the telemetry data was obtained from the TRD section 4.1 and from the ORD pages 4.7.14-1 thru 4.7.14-3.)

An alternate method of calculating the magnetic field is to use the low resolution data. This is primarily for contingency and cross-checking purposes. Measurements L4007 thru L4009 are used for this. Use the following equations to calcuate the magnetic field in sensor coordinates:

$$Bx1 = Ax * (Vx1 - Vox) + Cx + Kx(W)$$

$$By1 = Ay * (Vy1 - Voy) + Cx + Kx(W)$$

$$Bz1 = AZ * (Vz1 - Voz) + Cx + Kx(W)$$

Where the constants are the same as described for the high resolution equations. (From: TRD, section 4.2)

FLUXGATE MAGNETOMETER

The fluxgate action of the magnetometer is based on the time variation of the core permeability. The sensing element of a magnetometer is a core of permalloy or of a similiar material which has a high permeability and so becomes magnetically saturated in very low magnetic fields. A periodically changing magnetic field is applied to the core by a solenoid and a generator which magnetises the core to saturation. As the core becomes saturated, the permeability of the material is reduced and so the permeability varies periodically as the core switches from one polarity of saturation to the other. As the permeability has its minumum value when the magnetising current has its peak negative and positive values, the permeability of the core will have twice the frequency of the magnetising current. The output signal contains a component of this second harmonic of the magnetising frequency and this component is proportional to the component of the ambient magnetic field along the axis of the secondary winding. (From "Fluxgate Magnetometers" by F. Primdahl, Plasma Group, Danish meteorological Institute, Technical University of Denmark; TRD, page 67; McGraw-Hill Encyclopedia of Science and Technology, 1971, volume 8)

APPENDIX 4

ECLIPSE TIMES

ECLIPSE TIMES

APPENDIX 4 — 1979 SPRING ECLIPSE

DATE	PEN. ENTRY	UMB. ENTRY	UMB. EXIT	PEN. EXIT
3-16-79	20:45:39			20:59:00
3-17-79	20:20:30	20:30:24	20:33:00	20:43:01
3-18-79	19:56:47	20:02:06	20:20:10	20:25:36
3-19-79	19:33:41	19:37:55	20:03:14	20:07:35
3-20-79	19:10:58	19:14:37	19:45:26	19:49:12
3-21-79	18:48:32	18:51:48	19:27:11	19:30:34
3-22-79	18:26:20	18:29:20	19:08:38	19:11:46
3-23-79	18:04:18	18:07:07	18:49:53	18:52:49
3-24-79	17:42:26	17:45:06	18:30:58	18:33:44
3-25-79	17:20:42	17:23:14	18:11:54	18:14:33
3-26-79	16:59:04	17:01:30	17:52:42	17:55:16
3-27-79	16:37:32	16:39:53	17:33:23	17:35:52
3-28-79	10:47:27	(PARTIAL LUNAR ECLIPSE)		12:28:22
3-28-79	16:16:04	16:18:22	17:13:58	17:16:22
3-29-79	15:54:41	15:56:55	16:54:26	16:56:48
3-30-79	15:33:23	15:35:34	16:34:51	16:37:09
3-31-79	15:12:10	15:14:19	16:15:10	16:17:27
4-01-79	14:51:02	14:53:10	15:55:26	15:57:41
4-02-79	14:30:00	14:32:06	15:35:40	15:37:53
4-03-79	14:09:04	14:11:09	15:15:50	15:18:02
4-04-79	13:48:14	13:50:18	14:55;57	14:58:08
4-05-79	13:27:29	13:29:32	14:36:02	14:38:13
4-06-79	13:06:50	13:08:53	14:16:03	14:18:14

4-07-79	12:46:16	12:48:19	13:56:02	13:58:13
4-08-79	12:25:47	12:27:51	13:35:58	13:38:09
4-09-79	12:05:24	12:07:28	13:15:49	13:18:01
4-10-79	11:45:05	11:47:10	12:55:37	12:57:50
4-11-79	11:24:51	11:26:58	12:35:21	12:37:35
4-12-79	11:04:42	11:06:50	12:14:60	12:17:15
4-13-79	10:44:38	10:46:48	11:54:34	11:56:51
4-14-79	10:24:39	10:26:51	11:34:03	11:36:22
4-15-79	10:04:46	10:07:01	11:13:26	11:15:48
4-16-79	09:45:00	09:47:18	10:52:45	10:55:10
4-17-79	09:25:21	09:27:42	10:31:58	10:34:26
4-18-79	09:05:50	09:08:15	10:11:05	10:13:38
4-19-79	08:46:27	08:48:58	09:50:06	09:52:44
4-20-79	08:27:14	08:29:50	09:29:00	09:31:44
4-21-79	08:08:11	08:10:54	09:07:47	09:10:38
4-22-79	07:49:18	07:52:10	08:46:23	08:49:24
4-23-79	07:30:36	07:33:40	08:24:48	08:27:60
4-24-79	07:12:06	07:15:24	08:02:58	08:06:23
4-25-79	06:53:52	06:57:28	07:40:48	07:44:33
4-26-79	06:35:55	06:39:58	07:18:13	07:22:24
4-27-79	06:18:23	06:23:07	06:54:59	06:59:51
4-28-79	06:01:26	06:07:27	06:30:36	06:36:44
4-29-79	05:45:29	05:56:38	06:01:23	06:12:40
4-30-79	05:32:04			05:46:06

1979 FALL ECLIPSE

9-20-79	07:40:37			08:00:60
9-21-79	07:15:39	07:22:27	07:38:30	07:45:10
9-22-79	06:51:60	06:56:56	07:23:13	07:28:01
9-23-79	06:29:00	06:33:07	07:06:13	07:10:12
9-24-79	06:06:26	06:10:04	06:48:26	06:51:56
9-25-79	05:44:12	05:47:29	06:30:11	06:33:20
9-26-79	05:22:12	05:25:14	06:11:35	06:14:29
9-27-79	05:00:23	05:03:13	05:52:42	05:55:25
9-28-79	04:38:43	04:41:24	05:33:36	05:36:09
9-29-79	04:17:11	04:19:45	05:14:17	05:16:43
9-30-79	03:55:46	03:58:13	04:54:47	04:57:07
10-01-79	03:34:25	03:36:48	04:35:07	04:37:22
10-02-79	03:13:10	03:15:28	04:15:18	04:17:29
10-03-79	02:52:00	02:54:14	03:55:21	03:57:28
10-04-79	02:30:55	02:33:06	03:35:17	03:37:21
10-05-79	02:09:56	02:12:04	03:15:08	03:17:09
10-06-79	01:49:02	01:51:08	02:54:53	02:56:52
10-07-79	01:28:13	01:30:17	02:34:34	02:36:31
10-08-79	01:07:28	01:09:30	02:14:11	02:16:06
10-09-79	00:46:47	00:48:48	01:53:42	01:55:36
10-10-79	00:26:09	00:28:09	01:33:08	01:35:01
10-11-79	00:05:34	00:07:33	01:12:29	01:14:21
10-12-79	23:45:01	23:46:59	00:51:44	00:53:36
10-13-79	23:24:30	23:26:28	00:30:54	00:32:45
10-14-79	23:04:01	23:05:59	00:09:57	00:11:48
10-15-79	22:43:34	22:45:32	23:48:56	23:50:47

10-16-79	22:23:09	22:25:08	23:27:49	23:29:40
10-17-79	22:02:47	22:04:46	23:06:37	23:08:29
10-18-79	21:42:28	21:44:28	22:45:20	22:47:13
10-19-79	21:22:12	21:24:13	22:23:59	22:25:53
10-20-79	21:01:59	21:04:02	22:02:34	22:04:30
10-21-79	20:41:50	20:43:54	21:41:04	21:43:02
10-22-79	20:21:45	20:23:51	21:19:30	21:21:30
10-23-79	20:01:44	20:03:52	20:57:52	20:59:55
10-24-79	19:41:48	19:43:59	20:36:10	20:30:15
10-25-79	19:21:55	19:24:11	20:14:21	20:16:30
10-26-79	19:02:07	19:04:27	19:52:26	19:54:40
10-27-79	18:42:24	18:44:50	19:30:24	19:32:44
10-28-79	18:22:46	18:25:18	10:08:13	19:10:40
10-29-79	18:03:13	18:05:54	18:45:53	18:48:28
10-30-79	17:43:47	17:46:39	18:23:21	18:26:07
10-31-79	17:24:29	17:27:37	18:00:35	18:03:36
11-01-79	17:05:23	17:08:52	17:37:31	17:40:54
11-02-79	16:46:32	16:50:34	17:14:00	17:17:57
11-03-79	16:28:04	16:33:10	16:49:39	16:54:39
11-04-79	16:10:15			16:30:45
11-05-79	15:53:37			16:05:21

1980 SPRING ECLIPSE

3-13-90	17:18:11			17:36:20
3-14-80	16:54:31	17:00:46	17:12:46	17:19:08
3-15-80	16:30:48	16:35:17	16:56:23	17:00:58
3-16-80	16:07:34	16:11:18	16:38:30	16:42:20
3-17-80	15:44:39	15:47:56	16:19:58	16:23:22
3-18-80	15:21:56	15:24:55	16:01:04	16:04:10
3-19-80	14:59:25	15:02:11	15:41:55	15:44:47
3-20-80	14:37:02	14:39:38	15:22:34	15:25:16
3-21-80	14:14:48	14:17:16	15:03:04	15:05:39
3-22-80	13:52:42	13:55:03	14:43:28	14:45:56
3-23-80	13:30:43	13:32:59	14:23:46	14:26:09
3-24-80	13:08:51	13:11:03	14:03:60	14:06:19
3-25-80	12:47:06	12:49:14	13:44:09	13:46:24
3-26-80	12:25:26	12:27:31	13:24:14	13:26:26
3-27-80	12:03:52	12:05:55	13:04:14	13:06:24
3-28-80	11:42:22	11:44:23	12:44:11	12:46:19
3-29-80	11:20:57	11:22:57	12:24:03	12:26:09
3-30-80	10:59:37	11:01:35	12:03:51	12:05:56
3-31-80	10:38:20	10:40:17	11:43:35	11:45:39
4-01-80	10:17:07	10:19:04	11:23:14	11:25:18
4-02-80	09:55:58	09:57:54	11:02:50	11:04:53
4-03-80	09:34:53	09:36:49	10:42:21	10:44:24
4-04-80	09:13:52	09:15:48	10:27:48	10:23:52
4-05-80	08:52:55	08:54:52	10:01:11	10:03:15
4-06-80	08:32:03	08:34:01	09:40:30	09:42:35
4-07-80	08:11:17	08:13:15	09:19:46	09:21:51

4-08-80	07:50:36	07:52:35	08:58:58	09:01:05
4-09-80	07:30:01	07:32:02	08:38:06	08:40:15
4-10-80	07:09:32	07:11:35	08:17:11	08:19:22
4-11-80	06:49:09	06:51:14	07:56:12	07:58:25
4-12-80	06:28:52	06:31:00	07:35:08	07:37:24
4-13-80	06:08:41	06:10:52	07:13:59	07:16:17
4-14-80	05:48:36	05:50:50	06:52:43	06:55:05
4-15-80	05:28:36	05:30:55	06:31:20	06:33:46
4-16-80	05:08:44	05:11:08	06:09:49	06:12:21
4-17-80	04:48:59	04:51:29	05:48:10	05:50:47
4-18-80	04:29:23	04:32:00	05:26:21	05:29:06
4-19-80	04:09:58	04:12:45	05:04:23	05:07:17
4-20-80	03:50:47	03:53:44	04:42:13	04:45:18
4-21-80	03:31:50	03:35:02	04:19:48	04:23:09
4-22-80	03:13:10	03:16:43	03:57:05	04:00:45
4-23-80	02:54:53	02:58:55	03:33:54	03:38:04
4-24-80	02:37:05	02:41:55	03:09:59	03:14:57
4-25-80	02:19:59	02:26:33	02:44:29	02:51:11
4-26-80	02:04:12			02:26:09

APPENDIX 5

MEASUREMENT LIST

P78-2 MEASUREMENT LIST HEADING DEFINITIONS

M A CHARACTER IN COLUMN ONE INDICATES THAT A MODIFICATION HAS BEEN MADE SINCE THE LAST PUBLICATION OF THE MEASUREMENT LIST. THE MODIFICATION STATUS BEGINS AT 1 FOR A P78-2 MEASUREMENT LIST IN THE ORD AND SEQUENTIALLY INCREASES FOR EACH P78-2 MEASUREMENT LIST PUBLISHED TILL THE P78-2 MEASUREMENT LIST IS ASSIGNED A NEW REVISION LETTER (BEGINNING WITH "A" AND CONTINUING ON THROUGH THE ALPHABET). NOTE: SEE THE LINE ABOVE THE SUBSYSTEM OR EXPERIMENT TITLE ON EACH PAGE FOR THE REVISION DATE AND LETTER. THE DATE AND REVISION OF THE PREVIOUS P78-2 MEASUREMENT LIST BEING INCORPORATED INTO THE NEW P78-2 MEASUREMENT LIST IS ALSO GIVEN.

ANY CHANGE TO A MEASUREMENT LINE, OTHER THAN THE ADDITION OR DELETION OF A BLANK SPACE, WILL CONSTITUTE A MODIFICATION.

S

\+ A "+" IN COLUMN TWO INDICATES THE MEASUREMENT IS SUBCOMMUTATED *
NOTE: .A MEASURMENT IS CONSIDERED SUBCOMMUTATED IF IT SHARES A *
VEHICLE/PAYLOAD INTERFACE WIRE WITH 1 OR MORE OTHER MEASUREMENTS*
SEE SECTION 3.3 FOR A DESCRIPTION OF THE VARIOUS SUBCOMS. *

X AN "X" IN COLUMN TWO INDICATES THAT THE MEASUREMENT WAS DELETED *
AND/OR REPLACED BY ANOTHER MEASUREMENT. *

MEAS NO (COLUMNS 3-7)

THE FIVE CHARACTER NUMBER ASSIGNED TO EACH MEASUREMENT: THE FIRST CHARACTER--AN ALPHA--DENOTES THE PARTICULAR SUBSYSTEM OR EXPERIMENT WHERE A MEASUREMENT ORIGINATES. ALPHA CHARACTERS ARE DESIGNATED AS FOLLOWS:

	EXPT		EXPT		SUBSYSTEM
A	SC1	G	SC7	N	SV AC&D
B	SC2	H	SC8	P	SV PROPULSION
C	SC3	J	SC9	R	SV THERMAL (TCS)
D	SC4	K	SC10	S	SV STRUCTURES
E	SC5	L	SC11	T	SV TT&C & TPM
F	SC6	M	ML12	V	SV EPS

*** THE MEASUREMENT LIST IS ARRANGED IN THE SAME ALPHABETIC ORDER ***

THE SECOND CHARACTER--ONE OF FOUR DIGITS--DESIGNATES THE TYPE OF MEASUREMENT SIGNAL AS FOLLOWS:

2 BILEVEL (DISCRETE)
4 ANALOG
6 BROADBAND
8 DIGITAL

SEE NOTE ON PAGE 6.1-05 CONCERNING MEASUREMENT TYPE. *

THE LAST THREE CHARACTERS ARE SEQUENTIAL NUMBERS TO PROVIDE A UNIQUE MEASUREMENT NUMBER FOR EACH MEASUREMENT FROM A GIVEN SUBSYSTEM OR EXPERIMENT.

P78-2 MEASUREMENT LIST HEADING DEFINITIONS

MEASUREMENT NAME/MNEMONIC (COLUMNS 9-49)

THE MEASUREMENT DEFINITION OR DESCRIPTION AND A MNEMONIC ABBREVIATION--7 CHARACTERS OR LESS--OF THE MEASUREMENT NAME (MNEMONICS WILL NOT PURPOSELY APPEAR IN THE ACRONYMS AND ABBREVIATIONS LIST)

RANGE MIN MAX (COLUMNS 51-66)

THE NOTATION "CAL TABLE" BELOW THE MIN/MAX VALUES INDICATES THAT A CALIBRATION TABLE FOR THIS MEASUREMENT IS PROVIDED IN SEC 6.1.1

FOR BILEVELS- THE FALSE (0) AND TRUE (1) NOMINAL VOLTAGE LEVELS

FOR DIGITALS- THE TOTAL NUMBER OF BITS IN THE MEASUREMENT OR THE RANGE OF VALUES REPRESENTED BY THE N-BIT MEASUREMENT.

FOR ANALOGS- THE EXTENT OF THE SENSOR CALIBRATION, THE ANALOG TO DIGITAL OUTPUT, OR THE TRANSDUCER OUTPUT. ONLY ONE OF THESE RANGES IS GIVEN AND IS REFERED TO AS THE "TRANSDUCER RANGE".

***** SEE SECTION 4.7.1 FOR DISPLAY CONVERSION REQUIREMENTS *****

THE SMALLEST SUBSET OF THE TRANSDUCER RANGE THAT STILL CONTAINS THE SUCCESSFUL OR NORMAL OPERATING LIMITS IS REFERED TO AS THE "OPERATING RANGE" AND IS GIVEN IN THE "NOTES" COLUMN. IN CASES WHERE THE OPERATING RANGE IS THE SAME AS THE TRANSDUCER RANGE, ONLY THE TRANSDUCER RANGE IS GIVEN.

THE SUBSET OF THE TRANSDUCER RANGE THAT CORRESPONDS TO THE SENSOR OR MONITORED INSTRUMENT BEING IN AN OFF CONDITION IS REFERED TO AS THE "OFF RANGE". THE OFF RANGE IS ONLY LISTED IN THE "NOTES" COLUMN IF IT LIES OUTSIDE OF THE OPERATING RANGE.

THE DIFFERENCE BETWEEN THE TRANSDUCER RANGE AND THE OPERATING RANGE IS REFERED TO AS THE "FAILURE RANGE". THE FAILURE RANGE IS ONLY GIVEN WHEN IT COINCIDES WITH THE OFF RANGE. (THE OFF RANGE BECOMES A FAILURE RANGE WHEN THE DEVICE IS SWITCHED FROM AN OFF CONDITION TO AN ON CONDITION.)

IN SOME CASES, THE RANGE DATA IS TBD AND THE RANGE AND UNITS ARE GIVEN AS "0 TO NMAX DECI" WHERE NMAX IS THE MAXIMUM VALUE REPRESENTED BY AN N-BIT WORD; OR THE RANGE IS GIVEN AS "N TO N BITS". THESE WILL BE UPDATED AS CALIBRATION DATA BECOMES AVAILABLE FROM TEST.

UNIT (COLUMNS 67-70)

THE UNITS THE RANGE IS MEASURED IN. SEE BELOW FOR ACRONYMS AND ABBREVIATIONS USED.

RATE SPS (COLUMNS 72-77)

THE MEASUREMENT SAMPLE RATE GIVEN IN SAMPLES PER SECOND

P78-2 MEASUREMENT LIST HEADING DEFINITIONS

LOCATION (COLUMNS 78-88)
WD1-FR1-BIT

WORD NUMBER-MAIN FRAME START NUMBER-START & END BIT NUMBER THESE NUMBERS DEFINE THE LOCATION OF THE MEASUREMENT IN THE PCM ENCODER FORMATS. SECTION 3.3 DESCRIBES THE WORD-FRAME-BIT NUMBERING SYSTEM USED FOR P78-2. THERE ARE TWO MEASUREMENT LISTS GIVEN BELOW - ONE FOR THE 8192 BPS TRANSFER ORBIT AND FINAL ORBIT FORMATS AND ONE FOR THE 512 BPS AUXILLIARY PCM FORMAT. THESE ARE IDENTIFIED IN THE FIRST LINE OF EACH PAGE HEADING IN COLUMNS 75-82 AS 8192 BPS OR 512 BPS.

IF THE MEASUREMENT SPANS A WORD BOUNDARY (INDICATED BY A "&" IN COLUMN 89), THE LOCATION SPECIFICATION IS CONTINUED IN COLUMNS 90-100 FOR AS MANY LINES AS NECESSARY.

IF THE MEASUREMENT IS SAMPLED MORE THAN ONCE PER MAIN FRAME OR IS NOT IN THE SAME WORD IN OTHER MAIN FRAMES (+ IN 89), THE LOCATION SPECIFICATION IS GIVEN IN COLUMNS 78-88 FOR AS MANY LINES AS REQUIRED

OTHER INFORMATION ON THE MEASUREMENT LOCATION IS GIVEN IN THE NOTES COLUMN AS NECESSARY. THE MAIN FRAME NUMBERS CAN BE CALCULATED FROM THE SAMPLE RATE AND MAIN FRAME START NUMBER AS SHOWN BELOW.

8192 BPS	512 BPS
8 BITS PER WORD	8 BITS PER WORD
1024 WORDS/SEC	64 WORDS/SEC
128 WORDS/MAIN FRAME	64 WORDS/MAIN FRAME
8 MAIN FRAMES/SEC	1 MAIN FRAME/SEC
128 MAIN FRAMES/MASTER FRAME	4 MAIN FRAMES/MASTER FRAME
1 MASTER FRAME/16 SEC	1 MASTER FRAME/4 SEC

** 8192 BPS FORMATS **

SAMPLES PER SECOND	SAMPLES PER MAIN FRAME	SAMPLES PER MASTER FRAME	MAIN FRAME NUMBERS
1/16	1/128	1	MF=FR1
1/8	1/64	2	MF=64*N+FR1, N=0,1
1/4	1/32	4	MF=32*N+FR1, N=0,3
3/8	3/64	6	
1/2	1/16	8	MF=16*N+FR1, N=0,7
1	1/8	16	MF=8*N+FR1, N=0,15
2	1/4	32	MF=4*N+FR1, N=0,31
3	3/8	48	
4	1/2	64	MF=2*N+FR1, N=0,63
5	5/8	80	
8	1	128	MF=N, N=0,127
16	2	256	
32	4	512	
48	6	768	

P78-2 MEASUREMENT LIST HEADING DEFINITIONS

STATUS OR WD2-FR2-BIT (COLUMNS 90-100)

FOR BILEVELS ONLY - THE ON-WIRE STATUS OF A 0 SIGNAL AND A 1 SIGNAL, E.G. 0=XXXX 1=YYYY.

FOR ANALOGS AND DIGITALS - THE CONTINUATION OF THE MEASUREMENT LOCATION AS DESCRIBED ABOVE.

NOTES (COLUMNS 102-132)

THESE COLUMNS ARE FOR THE PRESENTATION OF CHARACTERISTICS NOT SHARED BY ALL MEASURMENTS AND FOR THE INCLUSION OF DATA THAT CANNOT BE LISTED IN THE APPROPRIATE COLUMN DUE TO LENGTH. SOME TYPICAL NOTES OF IMPORTANCE ARE -

BILEVEL A2XXX - THE BILEVEL CORRESPONDING TO THE MEASUREMENT STATED

SEE ORD TABLE N.K-M - REFERENCES LOCATION IN THE ORD OF INFORMATION CONCERNING THE TELEMETRY BIT PATTERNS OR ANOMALIES IN THE COMMUTATION OF THE MEASUREMENT E.G., MEASUREMENTS NOT SYNCHRONIZED WITHIN THE PCM ENCODER.

INFORMATION REGARDING SUBSETS OF RANGES

IN SOME CASES, SERIAL DIGITAL MEASUREMENTS HAVE BEEN ASSIGNED ANALOG OR BILEVEL MEASUREMENT NUMBERS TO ACCOMODATE GROUND TEST SOFTWARE LIMITATIONS. SUCH MEASUREMENTS ARE NOTED BY GIVING THE SERIAL DIGITAL CHANNEL NUMBER IN THE NOTES COLUMN (EG, SD13). ALSO, SOME BILEVELS HAVE BEEN COMBINED AND ASSIGNED DIGITAL MEASUREMENT NUMBERS. THE TRUE CHANNEL TYPES ARE LISTED IN TABLES 3.3-1, 3.3-2, AND 3.3-19.

ACRONYMS AND ABBREVIATIONS USED IN THE MEASUREMENT LIST

A/B	AIR-BORNE
AC&D	ATTITUDE CONTROL AND DETERMINATION
ACT	ACTIVATE
AGC	AUTOMATIC GAIN CONTROL
AIM	APOGEE INSERTION MOTOR
AMPLTD	AMPLITUDE
ATCH	ATTACHED
A-TO-D	ANALOG TO DIGITAL CONVERTER
AUTO	AUTOMATIC
AUX	AUXILIARY
BATT	BATTERY
BB	BROADBAND
BOT	BEGINNING OF TAPE
BPS	BITS PER SECOND
BSBND	BASEBAND
BT	BOTTOM
CAL	CALIBRATION
CAT	CATALYST
CDU	COMMAND DISTRIBUTION UNIT
CEA	CONTROL ELECTRONICS ASSEMBLY
CLSD	CLOSED
CM	COMMON MODE
CMD	COMMAND
CNTRL	CONTROL
COIN	COINCIDENCE
COINC.	COINCIDENCE
CPS	COUNTS PER SECOND
CRM	COUNT RATE MONITOR
CTS	COUNTS
CUR.	CURRENT
DACT	DEACTIVATE
DB	DECIBELS
DECI	DECIMAL
DEG	DEGREES
DEGC	DEGREES CELSIUS
DEGF	DEGREES FAHRENHEIT
DEMOD	DEMODULATOR
DNRG	DE-ENERGIZE
DSABL	DISABLE
DSAS	DIGITAL SUN ANGLE SENSOR
DSBL	DISABLE
DUM	DUMMY
DWLL	DWELL
E	ELECTRON (E IS JUST A LABEL IN THE SCS EXPERIMENT)
ELEC	ELECTRIC
ENABL	ENABLE
ENBL	ENABLE
ENCD	ENCODER
ENG	ENGINE
EOT	END OF TAPE
EPS	ELECTRICAL POWER SUBSYSTEM
ERR	ERROR
ESA	ELECTROSTATIC ANALYZER

ACRONYMS (CONTINUED)

EW	EAST/WEST (AN SC9 DETECTOR)
EXEC	EXECUTE
EXT.	EXTERNAL
FD	FIXED (AN SC9 DETECTOR)
FEXT	FULLY EXETENDED
FFD	FAST FORWARD
FINL	FINAL
FLD	FOLDED
FOV	FIELD OF VIEW
FT	FEET
FTRC	FULLY RETRACTED
GND	GROUND
GAMM	GAMMAS (MAGNETIC FIELD UNIT)
HTR	HEATER
H.V.	HIGH VOLTAGE
HYDR	HYDRAZINE
HZ	HERTZ
I.D.	IDENTIFICATION
IMOT	IN MOTION
INC	INCORPORATES
INHB	INHIBIT
INPT	INPUT
INT	INTERNAL
INTGRL	INTEGRAL
K	KILO
KCTS	KILO-COUNTS
KV	KILO-VOLTS
LSB	LEAST SIGNIFICANT BIT
LSV	LATCHING SOLENOID VALVE
MA	MILLI-AMPS
MAG	MAGNETOMETER
MAGN	MAGNETIC
MF(S)	MAIN FRAME(S)
MHZ	MEGA-HERTZ
MIDPT	MIDPOINT
ML12	MATERIALS EXPERIMENT 12
MLTIPLXR	MULTIPLEXER
MODE0	IN MODE 0
MSB	MOST SIGNIFICANT BIT
NAMP	NANOAMPERE
NBOT	NOT BEGINNING OF TAPE
NDTA	NO DATA
NEG.	NEGATIVE
NEOT	NOT END OF TAPE
NEUT	NEUTRALIZER
NEXT	NOT FULLY EXTENDED
NFFD	NOT FAST FORWARD
NMDO	NOT IN MODE 0
NMOT	NOT IN MOTION
NO.	NUMBER
NRCD	NOT RECORDING
NRG	ENERGIZE
NRPR	NOT REPRODUCING

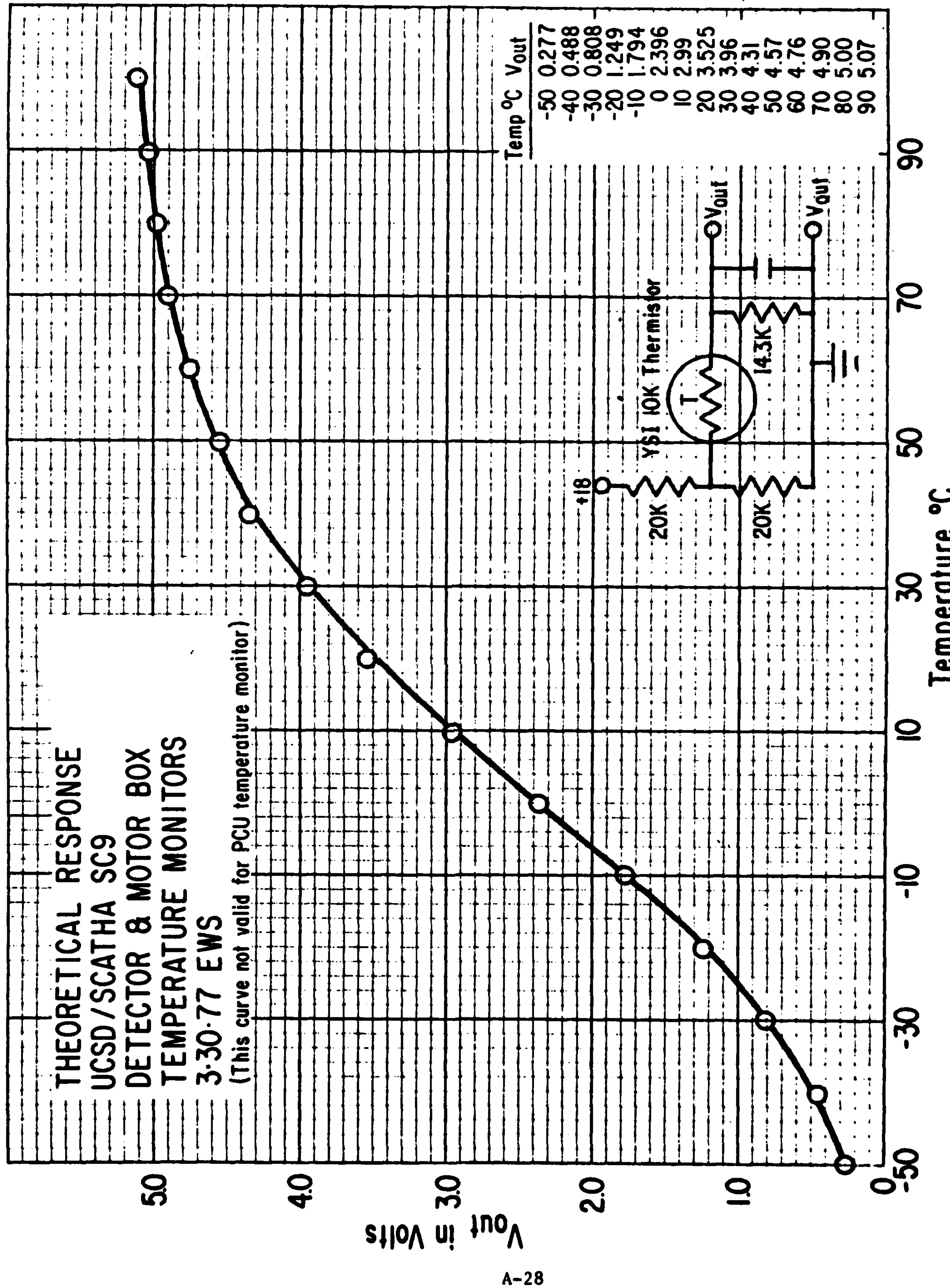
ACRONYMS (CONTINUED)

NS	NORTH/SOUTH (AN SC9 DETECTOR)
NSEL	NOT SELECTED
NSYN	NOT SYNCHRONIZED
NTRC	NOT FULLY RETRACTED
OCTL	OCTAL
OFU	ORDNANCE FIRING UNIT
OM	OMNI
OPLIM	NOMINAL OPERATING LIMITS
OP/O	OPERATE/OFF
OPORB	OPERATIONAL ORBIT
OPRT	OPERATE
ORD	ORBITAL REQUIREMENTS DOCUMENT
P	PROTON
PARA.	PARALLEL
PCM	PULSE CODE MODULATION
PCU	POWER CONTROL UNIT
PDNG	PRIMARY DE-ENERGIZE
PENG	PRIMARY ENERGIZE
PERP.	PERPENDICULAR
PHA	PULSE-HEIGHT-ANALYZER
POS	POSITION
POSI.	POSITIVE
PPA	POWER PROCESSOR ASSEMBLY
PRIM	PRIMARY
PROC.	PROCESSING
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSK	PHASE SHIFT KEY
PWR	POWER
RC	RECEIVER
RCD	RECORDING
RCVR	RECEIVER
REF	REFERENCE
REM	ROCKET ENGINE MODULE
RF	RADIO FREQUENCY
RJCT	REJECT
RLSD	RELEASED
RPA	RETARDING POTENTIAL ANALYZER
RPM	REVOLUTIONS PER MINUTE
RPR	REPRODUCING
RSET	RESET
S-#/#	SWITCH NUMBER __/POSITION NUMBER __
SC#	SCIENTIFIC EXPERIMENT NUMBER __
SCND	SECONDARY
SDNG	SECONDARY DE-ENERGIZE
SEC(S)	SECOND(S)
SEL	SELECTED
SELCT	SELECT
SENG	SECONDARY ENERGIZE
SEP.	SEPARATED
SHCI	STEERABLE HORIZON CROSSING INDICATOR
SIG	SIGNAL

ACRONYMS (CONTINUED)

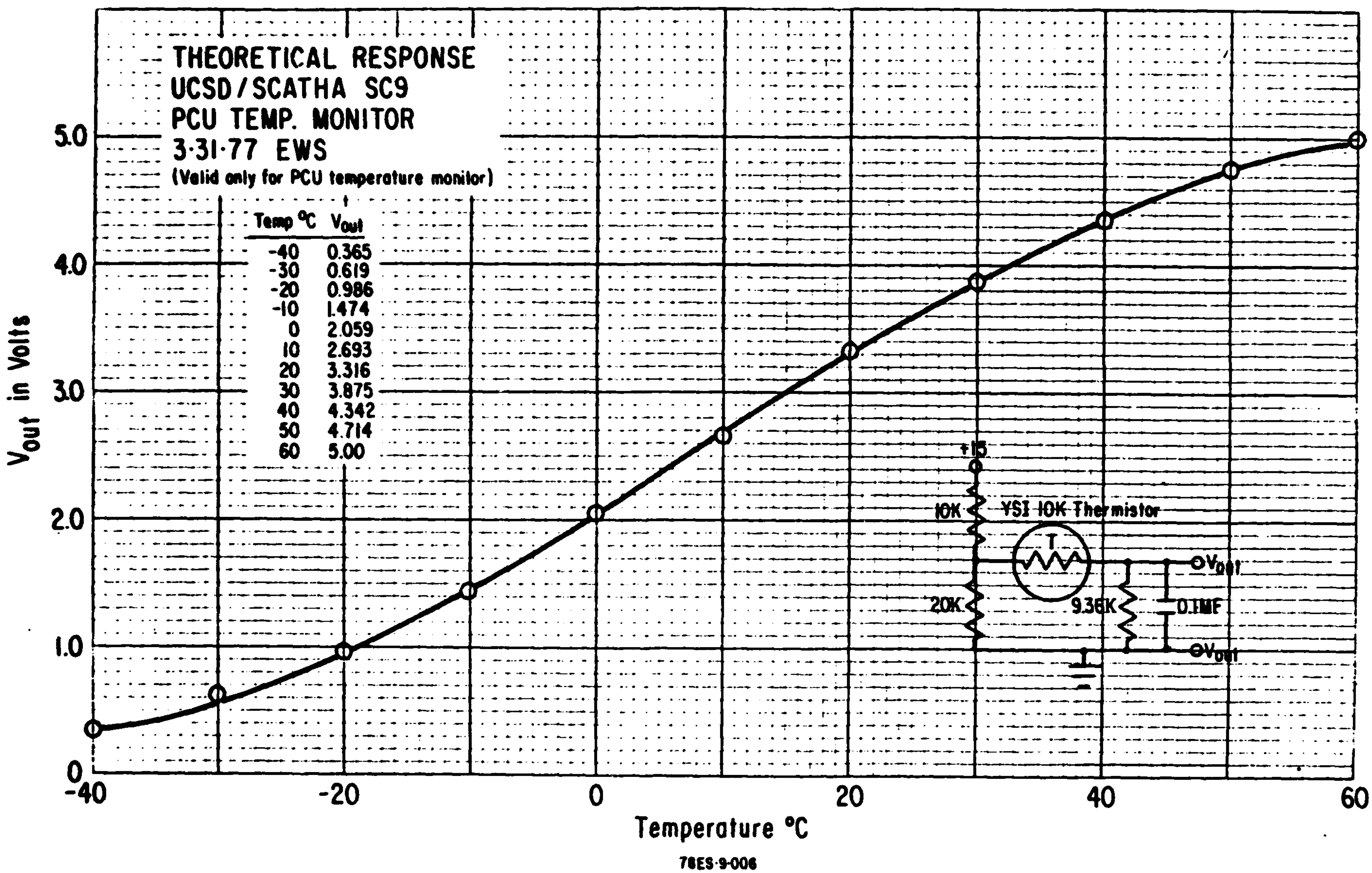
SNGL	SINGLE
SPIBS	SATELLITE POSITIVE ION BEAM SYSTEM
S/R	STANDBY/REJECT
SSD	SOLID STATE DETECTOR
SSS	SOLID STATE SPECTROMETER
STBY	STANDBY
SV	SPACE VEHICLE
SWCH	SWITCH
S/X	STANDBY/EXECUTE
TBD & ???	TO BE DETERMINED (IDENTIFIES A LACK OF INFORMATION)
TCS	THERMAL CONTROL SYSTEM
TDU	TIMING DISTRIBUTION UNIT
TEMP.	TEMPERATURE
TM	TELEMETRY
TMLCK	TELEMETRY LOCKED
TORB	TRANSFER ORBIT
TP	TOP
TPM	TRANSIENT PULSE MONITOR
TR	TAPE RECORDER
TRM	TERMINATED
TT&C	TELEMETRY, TRACKING AND COMMAND
V	VOLTS
VAC	VOLTS ALTERNATING CURRENT
VDA	VALVE DRIVE AMPLIFIER
VDC	VOLTS DIRECT CURRENT
VOLT.	VOLTAGE
VP	VOLTAGE POTENTIAL
VTCW	VEHICLE TIME CODE WORD
WD(S)	WORD(S)
XFER	TRANSFER
XM	TRANSMITTER
XMTR	TRANSMITTER
(+)	POSITIVE
(-)	NEGATIVE

Figure A.5-1



Temp °C	V_{out}
-50	0.277
-40	0.488
-30	0.808
-20	1.249
-10	1.794
0	2.396
10	2.99
20	3.525
30	3.96
40	4.31
50	4.57
60	4.76
70	4.90
80	5.00
90	5.07

Figure A.5-2



Temp °C	V_{out}
-40	0.365
-30	0.619
-20	0.986
-10	1.474
0	2.059
10	2.693
20	3.316
30	3.875
40	4.342
50	4.714
60	5.00

MS	P78-2 MEAS NO	SC9 EXPERIMENT MEASUREMENT NAME/MNEMONIC	RANGE MIN MAX	UNIT	RATE SPS	LOCATION WD1-FR1-BIT	STATUS OR WD2-FR2-BIT	NOTES
	J4001	(+) DEFLECTION VOLTAGE NORTH/SOUTH +DVNS	0 TO 5.1	VDC	1/016	102-107-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4002	(-) DEFLECTION VOLTAGE NORTH/SOUTH -DVNS	0 TO 5.1	VDC	1/016	102-108-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4003	(+) DEFLECTION VOLTAGE EAST/WEST +DVEW	0 TO 5.1	VDC	1/016	102-109-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4004	(-) DEFLECTION VOLTAGE EAST/WEST -DVEW	0 TO 5.1	VDC	1/016	102-110-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4005	(+) DEFLECTION VOLTAGE FIXED +DVFD	0 TO 5.1	VDC	1/016	102-111-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4006	(-) DEFLECTION VOLTAGE FIXED -DVFD	0 TO 5.1	VDC	1/016	102-112-1/8		0=OFF/FAIL; 1/5.1=OPRT
	J4007	SPIRALTRON VOLTAGE NORTH/SOUTH SVNS	0 TO 5.1	VDC	1/016	102-113-1/8		0=OFF/FAIL; 1/2=OPRT
	J4008	SPIRALTRON VOLTAGE EAST/WEST SVEW	0 TO 5.1	VDC	1/016	102-114-1/8		0=OFF/FAIL; 1/2=OPRT
	J4009	SPIRALTRON VOLTAGE FIXED SVFD	0 TO 5.1	VDC	1/016	102-115-1/8		0=OFF/FAIL; 1/2=OPRT
6	J4010	NORTH/SOUTH TEMPERATURE TNS	-50 TO 80 CAL TABLE	DEGC	1/016	102-116-1/8		-40/+50=OPRT; TEST RANGE IS -40/+70
6	J4011	EAST/WEST TEMPERATURE TEW	-50 TO 80 CAL TABLE	DEGC	1/016	102-117-1/8		-40/+50=OPRT; TEST RANGE IS -40/+70
6	J4012	MOTOR BOX TEMPERATURE TMB	-50 TO 80 CAL TABLE	DEGC	1/016	102-118-1/8		-40/+50=OPRT; TEST RANGE IS -40/+70
6	J4013	PCU TEMPERATURE TPCU	-40 TO 60 CAL TABLE	DEGC	1/016	102-119-1/8		-40/+50=OPRT
4	J4014	NS POSITION MONITOR (WORD 102) NSPOSS	0 TO 5.1	VDC	1/016	102-120-1/8		
4	J4015	EW POSITION MONITOR (WORD 102) EWPOSS	0 TO 5.1	VDC	1/016	102-121-1/8		
	J4016	PCU MONITOR PCUMON	0 TO 5.1	VDC	1/016	102-122-1/8		0=OFF/FAIL; 1.0+-0.1=OPRT
4	J4017	NS POSITION MONITOR (WORD 110) NSPOSF	0 TO 5.1	VDC	1/001	110-004-1/8		

P78-2 SC9 EXPERIMENT (28-FEB -78 REV C) SUPERSEDES (20-JAN -78 REV B) — 8192 BPS — SC9 EXPERIMENT

MS	P78-2 MEAS NO	SC9 EXPERIMENT MEASUREMENT NAME/MNEMONIC	RANGE MIN	RANGE MAX	UNIT	RATE SPS	LOCATION WD1-FR1-BIT	STATUS OR WD2-FR2-BIT	NOTES	
4	J4018	EW POSITION MONITOR (WORD 110) EWPOSF	0	TO 5.1	VDC	1/001	110-005-1/8			
+	J4501	ACCUMULATOR 1 (NS PROTONS) PNS	0	TO 65535	DECI	4/001	104-001-1/8&105-001-1/8		MF=2*N+1,N=0,63	SD15
+	J4502	ACUMMULATOR 3 (EW PROTONS) PEW	0	TO 65535	DECI	4/001	049-001-1/8&050-001-1/8		MF=2*N+1,N=0,63	SD9
+	J4503	ACCUMULATOR 5 (FD PROTONS) PFIXD	0	TO 65535	DECI	4/001	051-001-1/8&052-001-1/8		MF=2*N+1,N=0,63	SD10
+	J2504	SCAN SCAN	0	OR 10	VDC	4/001	106-000-2	0=DWLL 1=SCAN	MF=2*N,N=0,63	SD16
4+	J8505	DEFLECTION CONTROL COUNTER DCC	0	TO 63	DECI	4/001	106-000-3/8		MF=2*N,N=0,63	LC124-018
4+	J8506	NORTH/SOUTH POSITION COUNTER NSPC	0	TO 2047	DECI	1/001	106-001-1/8&106-005-6/8		MF=8*N+1,N=0,15	LC124-018
4+	J8507	EAST/WEST POSITION COUNTER EWPC	0	TO 2047	DECI	1/001	106-003-1/8&106-005-2/4		MF=8*N+3,N=0,15	LC124-018
+	J2508	COUNTER-CLOCKWISE EAST/WEST CCWEW	0	OR 10	VDC	1/001	106-005-1	0=TBD 1=TBD		SD16
+	J2509	COUNTER-CLOCKWISE NORTH/SOUTH CCWNS	0	OR 10	VDC	1/001	106-005-5	0=TBD 1=TBD		SD16
4+	J8510	NORTH/SOUTH LOWER LIMIT NSLL	0	TO 255	DECI	1/016	106-007-1/8			LC124-018
4+	J8511	NORTH/SOUTH UPPER LIMIT NSUL	0	TO 255	DECI	1/016	106-015-1/8			LC124-018
4+	J8512	EAST/WEST LOWER LIMIT EWLL	0	TO 255	DECI	1/016	106-023-1/8			LC124-018
4+	J8513	EAST/WEST UPPER LIMIT EWUL	0	TO 255	DECI	1/016	106-031-1/8			LC124-018
4+	J8532	DWELL TIME DT	0	TO 255	DECI	1/016	106-055-1/8			LC124-018
4+	J8533	DWELLS/CYCLE DN	0	TO 255	DECI	1/016	106-063-1/8			LC124-018
4+	J8534	INITIAL DWELL STEP IDI	0	TO 255	DECI	1/016	106-071-1/8			LC124-018

MS	MEAS NO	MEASUREMENT NAME/MNEMONIC	RANGE MIN MAX	UNIT	RATE SPS	LOCATION WD1-FR1-BIT	STATUS OR WD2-FR2-BIT	NOTES	
4+	J8535	DWELL STEP SIZE DS	0 TO 255	DECI	1/016	106-079-1/8			LC124-018
4+	J8538	ACCUMULATOR GATING AG	0 TO 255	DECI	1/016	106-087-1/8			LC124-018
4+	J8539	MOTOR POWER MP	0 TO 255	DECI	1/016	106-095-1/8			LC124-018
4+	J8545	LATCHING COMMANDS 1 THRU 7 STATUS LC:1-7	0 TO 255	DECI	1/016	106-103-1/8			LC124-018
4+	J8552	LATCHING COMMANDS 8 THRU 14 STATUS LC:8-14	0 TO 255	DECI	1/016	106-111-1/8			LC124-018
4+	J8559	COMMAND BUS CBUS	0 TO 255	DECI	1/016	106-119-1/8			LC124-018
4+	J8560	MAGNITUDE COMMAND HIGH MAGHI	0 TO 255	DECI	1/016	106-127-1/8			LC124-018
+	J4566	ACCUMULATOR 2 (NS ELECTRONS) ENS	0 TO 65535	DECI	4/001	104-000-1/8&	105-000-1/8	MF=2*N,N=0,63	SD15
+	J4567	ACCUMULATOR 4 (EW ELECTRONS) EEW	0 TO 65535	DECI	4/001	049-000-1/8&	050-000-1/8	MF=2*N,N=0,63	SD9
+	J4568	ACCUMULATOR 6 (FD PROTONS) PFIXE	0 TO 65535	DECI	4/001	051-000-1/8&	052-000-1/8	MF=2*N,N=0,63	SD10
4+	J8569	NORTH/SOUTH WAG,SWEEP AND PARK CNTRL NSPS	0 TO 255	DECI	1/016	106-039-1/8			LC124-018
4+	J8570	EAST/WEST WAG,SWEEP AND PARK CNTRL EWPS	0 TO 255	DECI	1/016	106-047-1/8			LC124-018
	J8100	SC9 MICROPROCESSOR STATUS	8 TO 8	BITS	8/001	100-000-1/8		VCO 545	
4	J6001	SC9 BROADBAND DATA SOURCES	0 TO 5	VOLT				3000 HZ SEE TABLE 3.3-24	

APPENDIX 6

DATA TAPE FORMAT

APPENDIX 6 SC9 - DATA TAPE FORMAT

THE SC-9 DATA TAPE IS 9 TRACK, 1600 BPI, ODD PARITY

THE RECORD SIZE IS 1024 16 BIT WORDS OR 2048 BYTES

THE BYTES ARE NUMBERED FROM 0 TO 2047

BYTE 0 IS PHYSICALLY THE FIRST BYTE ENCOUNTERED BY THE READ HEAD.

THE 2048 BYTE RECORD CONTAINS ALL DATA FOR 1 MASTER FRAME (16 SECONDS).

THE TAPE FORMAT SUMMARY IMMEDIATELY PRECLUDES THIS SECTION.

TERMINOLOGY:

BYTE: THE "BYTES" CORRESPOND TO EACH BYTE ON 9 TRACK TAPE. THEY ARE LISTED IN NUMERICAL ORDER.

MFR: MAINFRAME NUMBER OF THE ASSOCIATED MASTER FRAME OF DATA. MFR ALONG WITH "WORD" DEFINES THE DATA TO BE PLACED IN THE CORRESPONDING "BYTE" LOCATION ON TAPE.

WORD: TELEMETRY WORD FOR A GIVEN MFR.

TBD: TO BE DETERMINED.

*: NOT ASSOCIATED WITH SPACECRAFT TELEMETRY DATA

NOTE:

"STATUS NSWEP" DATA IS PLACED INTO TWO SEPARATE BYTES ON TAPE (FOR A GIVEN MFR, AND WORD). THIS IS BECAUSE THIS BYTE CONTAINS DATA BITS FOR BOTH "STATUS NSP" AND "STATUS EWP" DATA.

ALSO NOTE THAT UCSD GSE TAPES WILL DIFFER IN SOME AREAS WEHRE DATA FROM OTHER PAYLOADS IS TO BE PLACED.

TAPE FORMAT

File Description -

Each tape will consist of six files seperated by hardware tape marks (EOF) and terminated by a double hardware tape mark to to signify END OF INFORMATION. File and record descriptions are presented below:

File 1 - Header File

This file consists of a single record. It identifies the contents of the tape. Except for the first two bytes, the entire record is alphanumeric, recorded using the ASCII character set convention.

BYTE	TYPE	CONTENTS
1	Integer	130 (no. of Hollerith bytes in record)
2	Integer	1 (identifies record as an ID record)
3-12	Alpha	Vehicle ID (6HSCATHA)
13-22	Alpha	User ID (4HSCATHA)
23-32	Alpha	Data Format
33-42	Alpha	100% Digital Tape Number
43-52	Alpha	Acquisition Revolution Number
53-52	Alpha	Acquisition Year
63-72	Alpha	Acquisition Julian Date
73-82	Alpha	Start of Data, UT seconds
83-92	Alpha	End of Data, UT seconds
93-102	Alpha	Data Rate, bits per second
103-132	Alpha	Additional comments/blank fill

File 2 - Scan File

This file contains n 2049 byte records, where each pair of bytes is inverted according to the PDP convention. The data contained in this file are the UT time of the last good master frame before the master frame containing the out-of-sync main frame, the UT time of the master frame containing the out-of-sync main frame, the UT time of the bad main frame, the number of good

bytes in the out-of-sync main frame, and the UT time of the first good master frame after the out-of-sync main frame. The 'number of bytes' is expressed in two 8-bit bytes, and all times are contained in four 8-bit bytes, ordered 1-0-3-2.

File 3 - Event File

This file consists of all the commands sent to the spacecraft, in the form of: UT time, VTCW, and Command. Each record contains 2049 8-bit bytes. Pairs of bytes are inverted. UT time is as described in files 1. and 2. The VTCW is contained in four bytes and the commands (the commands consist of 32 bits. There are actually 33 bits, but they leave off the highest order bit) are contained in six bytes, all pairs of bytes are inverted.

File 4 - Ephemeris File

This file contains 69 parameters in 1200 8-bit bytes, encoded with ASCII characters. Each parameter has the format F15.3. The first parameter is contained in bytes 1-15, the second parameter is contained in bytes 16-30, ... and parameter 69 is contained in bytes 1001-1035. The parameters are defined in the enclosure. Each pair of 8-bit bytes have been inverted to comply with the PDP reading convention.

File 5 - Attitude File

NOTE: Not all tapes have an Attitude File, and some have the old format and others have a new version.

The old file parameters were:

	Parm. 1	Parm. 2	Parm. 3	Parm. 4
Card 1	Year	Day	BEGSEC	ENDSEC
Card 2	a	b	c	d
Card 3	RA	DEC	A	B
Card 4	Jx	Jy	Jz	$\overline{W}$

The defifnitions for the parameters are:

Year = Year of data
Day = Day of data
BEGSEC = Start time of span (Zulu seconds)
ENDSEC = End time of span (Zulu seconds)
a,b,d,c = Coefficients of a third degree polynomial espression for Theta in radians
Theta = The angle between the spacecraft Y* axis and the angular momentum X,Z plane,
Theta = a + bT + c(T*T) + d(T*T*T)
Ti = time of interest (seconds)
T = Ti - BEGSEC (seconds)
RA, DEC = Right ascension and declination of the angular momentum X(subA) or principal axis (radians)
A = The angle between the spacecraft Zs* axis and the principal axis.
B = The angle between the spacecraft Yx* axis and the principal axis.
Jx,Jy,Jz = The unit vector expressing the direction of the principal axis

in ECI coordinates.
$\bar{W}$ = Average spin rate (radians per second)

NOTE: The asterisk flags a change in definition from previous definition.

The new attitude file format is the same as the old format except for:

RA = AH
DEC = CH
A = AS
B = CS

Where:

AH = Right ascension of the principal axis on ECI.
CH = Declination of the principal axis on ECI.
AS,CS = Euler angles for principal axis misalignment. AS is equivalent to ETA3 and CS is equivalent to ETA2 as found in the Output Module, and Estimation Module.

File 6 - Telemetry File

The format of the Telemetry File follows.

SCATHA TAPE FORMAT

SUMMARY

BYTES	DESCRIPTION	MNEMONIC	TYPE
1-128	Subcom ID	ISUBCM(128)	Byte
129-192	Vehicle Time Code Wd	IVTCW(16)	Integer *4
193-256	Ground Time	IGT(16)	Integer *4
257-384	N/S Elec's	IACC2(64)	Integer
385-512	N/S Ions	IACC1(64)	Integer
513-640	E/W Elec's	IACC4(64)	Integer
641-768	E/W Ions	IACC3(64)	Integer
769-1024	Fixed Ions	IACC5(128)	Integer
1025-1152	Magx	MX(64)	Integer
1153-1280	Magy	MY(64)	Integer
1281-1408	Magz	MZ(64)	Integer
1409-1424	Magx direction	MXD(16)	Byte - integer*
1425-1440	Magy direction	MYD(16)	Byte - integer*
1441-1456	Magz direction	MZD(16)	Byte - integer*
1457	+DVNS		
1458	-DVNS		
1459	+DVEW	IDV(6)	Byte - integer
1460	-DVEW		
1461	+DVFD		
1462	-DVFD		
1463	SVNS		
1464	SVEW	ISV(3)	Byte - integer
1465	SVFD		

BYTES	DESPCRIPTION	MNEMONIC	TYPE	MEAS.	NO.
1466	Temp. N/S head	ITNS	Byte	J4010	50
1467	Temp. E/W head	ITEW	Byte	J4011	50
1468	Temp. motor box	ITMB	Byte	J4012	50
1469	Temp. power cond. unit	ITPCU	Byte	J4013	50
1470	N/S Pos. Monitor	NSPOS	Byte	J4014	50
1471	E/W Pos. Monitor	IEWPOS	Byte	J4015	50
1472	PCU Monitor	IPCUM	Byte	J4016	50
1473-1488	N/S Analog Position	NSP(16)	Byte	J4017	50
1489-1504	E/W Analog Position	IEWP(16)	Byte	J4018	51
1505-1536	Probe Voltage 1	IPV1(16)	Integer	B8008	17
1537-1568	Probe Voltage 2	IPV2(16)	Integer	B8028	18
1569-1576	Beam Curr. Flag 1-5	IBCF(5,8)	Byte	D2001-5	38
	Beam On/Off	IBON(8)	Byte	D2006	38
	Beam Duty Cyc. Flag	IBDCF(8)	Byte	D2007	38
	Beam Focus Flag 1	IBFF1(8)	Byte	D2008	38
1577-1584	Beam Focus Flag 2	IBFF2(8)	Byte	D2009	38
	Beam Energy Flag 1-4	IBEF(4,8)	Byte	D2010-13	38
	Gun Cap Deployment Flag	IGCDF(8)	Byte	D2014	38
	Blowoff Cover Status Flag	IBCSF(8)	Byte	D2015	39
	Neut. Bias Polarity Flag	NBPF(8)	Byte	D2016	39
1585-1600	Beam Current High	IBCH(16)	Byte	D4001	38
1601-1616	Beam Current Montr.	IBCM(16)	Byte	D4008	39
1617-1632	Neutralizer Emission	NE(16)	Byte	D4009	39
1633-1648	Spibs Net Current Monitor	ISNCM(16)	Byte	D4010	39
1649-1656	Discharge Current	IDCUR(8)	Byte	D4012	39
1657	High Volt. Monitor	IHVM	Byte	D4003	39
1658	Voltage Monitor 1	IVM1	Byte	D4004	39
1659	Voltage Monitor 2	IVM2	Byte	D4005	39
1660	Beam Volt. Monitor	IBVM	Byte	D4011	39
1661	Keeper Curr. Mon.	KCM	Byte	D4014	39
1662	Keeper High Volt. Monitor	KHVM	Byte	D4015	39
1663	Accelerator Current Monitor	IACM	Byte	D4018	39
1664	Decelerator Current Monitor	IDCM	Byte	D4019	40
1665	Neutralizer Htr Current Monitor	NHCM	Byte	D4020	40
1666	Neutralizer Bias Voltage Monitor	NBVM	Byte	D4021	40
1667-1674	Non-Critical Bus Voltage Monitor	NCBV(8)	Byte	V2007	80
1675-1682	Non-Critical Bus Current 1	NCBC1(8)	Byte	V4007	78
1683-1690	Non-Critical Bus	NCBC2(8)	Byte	V4008	78

	Current 2				
1691-1694	Solar Array Temp 1-4	ISAT(4)	Byte	V4015-18	78-79
1695-1710	Solar Array Curr. 1	ISAC1(16)	Byte	V4019	79
1711-1726	Solar Array Curr. 2	ISAC2(16)	Byte	V4020	79
1727	Shunt Reg. Temp.	ISRT	Byte	V4021	79
1728	PCU Temp. 1	IPCUT	Byte	V4026	79
1729-1792	Deflection Control Counter Step No.	IDC(64)	Byte	J8505	51
	Scan/Dwell	ISD(64)	Byte	J2504	51
1793-1825	Position	See NOTE at end of list			
1826-1856	Position	See NOTE at end of list			
1857	NS Lower Limit	NSLL	Byte	J8510	51
1858	NS Upper Limit	NSUL	Byte	J8511	51
1859	EW Lower Limit	IEWLL	Byte	J8512	51
1860	EW Upper Limit	IEWUL	Byte	J8513	51
1861	NS Wag, Sweep, and Park Control	NSPS	Byte	J8569	52
1862	EW Wag, Sweep, and Park Control	IEWPS	Byte	J8570	52
1863	Dwell Time	IDT	Byte	J8532	51
1864	No. of Dwell/Cycle	IDN	Byte	J8533	51
1865	Initial Dwell Step	ID1	Byte	J8534	51
1866	Dwell Step Size	IDS	Byte	J8535	52
1867	Accumulator Gating	IAG	Byte	J8538	52
1868	Motor Power	IMP	Byte	J8539	52
1869	Status Latching Command 1-7	LC1	Byte	J8545	52
1870	Status Latching Command 8-14	LC2	Byte	J8552	52
1871	Status Magnitude Commands (Bus) 1-8	MC1	Byte	J8559	52
1872	Status Magnitude Commands (High) 9-16	MC2	Byte	J8560	52
1873-1888	Elect. Channel 1	IEC1(16)	Byte	K4008	53
1889-1904	Elect. Channel 2	IEC2(16)	Byte	K4009	53
1905-1920	Elect. Channel 3	IEC3(16)	Byte	K4010	53
1921-1936	Elect. Channel 4	IEC4(16)	Byte	K4011	53
1937-1952	Magnetic Channel 1	IMC1(16)	Byte	K4012	53
1953-1968	Magnetic Channel 2	IMC2(16)	Byte	K4013	53
1969-1984	Magnetic Channel 3	IMC3(16)	Byte	K4014	54
1985-2000	Magnetic Channel 4	IMC4(16)	Byte	K4015	54
2001	Plus Calibration Verification	IPCV	Byte	K2001	53
	Minus Calibration	INCV	Byte	K2002	53
	Mag/Common Mode	MCMV	Byte	K2003	53
	Mode	MODE	Byte	K2004	53
2002-2013	DSAS Time Tag and Angle	IDTA(4)	Integer*4	N8008	62
2014-2048	Fill 0				

OTE: NSPC, ICSNS, IEWPC, and ICWEW in bytes 1793-1856 have been slightly scrambled on our tape. The correct, unscrambled version follows:

NOTE: NSPC, ICSNS, IEWPC, and ICWEW in bytes 1793-1856 have been slightly scrambled on our tape. The correct, unscrambled version follows:

```
      1793 = lowest 8 bits of NSPC
      1794 is:  MSB = ICWEW (1 bit) - EWPC bit 11 - EWPC bit 10 -
                      EWPC bit 9 - ICWNS (1 bit) - NSPC bit 11 -
                      NSPC bit 10 - NSPC bit 9 = LSB
                Where:
                       MSB = Most Signifigant Bit
                       LSB = Least Signifigant Bit

This pattern repeats until 1825
      1825 is:  MSB = ICWEW (1 bit) - EWPC bit 11 - EWPC bit 10 -
                      EWPC bit 9 - ICWNS (1 bit) - NSPC bit 11 -
                      NSPC bit 10 - NSPC bit 9 = LSB
                     (same form as 1794)
      1826 = lowest 8 bits of EWPC
      1827 is the scame as 1794
      And so forth thru 1856, where:
NSPC(16) = NS Pos. Counter; Integer; J8506; 51
ICWNS(16) = Counter-Clockwise NS; Byte; J2509; 51
IEWPC(16) = EW Pos. Counter; Intger; J8507; 51
ICWEW(16) = Counter-Clockwise Ew; Byte; J2508; 51
```

BYTE	MFR	WORD	DESCRIPTION	
0	0	124	MAIN FRAME ID =	0
1	1	124	MAIN FRAME ID =	1
2	2	124	MAIN FRAME ID =	2
3	3	124	MAIN FRAME ID =	3
4	4	124	MAIN FRAME ID =	4
5	5	124	MAIN FRAME ID =	5
6	6	124	MAIN FRAME ID =	6
7	7	124	MAIN FRAME ID =	7
8	8	124	MAIN FRAME ID =	8
9	9	124	MAIN FRAME ID =	9
10	10	124	MAIN FRAME ID =	10
11	11	124	MAIN FRAME ID =	11
12	12	124	MAIN FRAME ID =	12
13	13	124	MAIN FRAME ID =	13
14	14	124	MAIN FRAME ID =	14
15	15	124	MAIN FRAME ID =	15
16	16	124	MAIN FRAME ID =	16
17	17	124	MAIN FRAME ID =	17
18	18	124	MAIN FRAME ID =	18
19	19	124	MAIN FRAME ID =	19
20	20	124	MAIN FRAME ID =	20
21	21	124	MAIN FRAME ID =	21
22	22	124	MAIN FRAME ID =	22
23	23	124	MAIN FRAME ID =	23
24	24	124	MAIN FRAME ID =	24
25	25	124	MAIN FRAME ID =	25
26	26	124	MAIN FRAME ID =	26
27	27	124	MAIN FRAME ID =	27
28	28	124	MAIN FRAME ID =	28
29	29	124	MAIN FRAME ID =	29
30	30	124	MAIN FRAME ID =	30
31	31	124	MAIN FRAME ID =	31
32	32	124	MAIN FRAME ID =	32
33	33	124	MAIN FRAME ID =	33
34	34	124	MAIN FRAME ID =	34
35	35	124	MAIN FRAME ID =	35
36	36	124	MAIN FRAME ID =	36
37	37	124	MAIN FRAME ID =	37
38	38	124	MAIN FRAME ID =	38
39	39	124	MAIN FRAME ID =	39
40	40	124	MAIN FRAME ID =	40
41	41	124	MAIN FRAME ID =	41
42	42	124	MAIN FRAME ID =	42
43	43	124	MAIN FRAME ID =	43
44	44	124	MAIN FRAME ID =	44
45	45	124	MAIN FRAME ID =	45
46	46	124	MAIN FRAME ID =	46
47	47	124	MAIN FRAME ID =	47
48	48	124	MAIN FRAME ID =	48
49	49	124	MAIN FRAME ID =	49
50	50	124	MAIN FRAME ID =	50
51	51	124	MAIN FRAME ID =	51
52	52	124	MAIN FRAME ID =	52
53	53	124	MAIN FRAME ID =	53

54	54	124	MAIN FRAME ID =	54
55	55	124	MAIN FRAME ID =	55
56	56	124	MAIN FRAME ID =	56
57	57	124	MAIN FRAME ID =	57
58	58	124	MAIN FRAME ID =	58
59	59	124	MAIN FRAME ID =	59
60	60	124	MAIN FRAME ID =	60
61	61	124	MAIN FRAME ID =	61
62	62	124	MAIN FRAME ID =	62
63	63	124	MAIN FRAME ID =	63
64	64	124	MAIN FRAME ID =	64
65	65	124	MAIN FRAME ID =	65
66	66	124	MAIN FRAME ID =	66
67	67	124	MAIN FRAME ID =	67
68	68	124	MAIN FRAME ID =	68
69	69	124	MAIN FRAME ID =	69
70	70	124	MAIN FRAME ID =	70
71	71	124	MAIN FRAME ID =	71
72	72	124	MAIN FRAME ID =	72
73	73	124	MAIN FRAME ID =	73
74	74	124	MAIN FRAME ID =	74
75	75	124	MAIN FRAME ID =	75
76	76	124	MAIN FRAME ID =	76
77	77	124	MAIN FRAME ID =	77
78	78	124	MAIN FRAME ID =	78
79	79	124	MAIN FRAME ID =	79
80	80	124	MAIN FRAME ID =	80
81	81	124	MAIN FRAME ID =	81
82	82	124	MAIN FRAME ID =	82
83	83	124	MAIN FRAME ID =	83
84	84	124	MAIN FRAME ID =	84
85	85	124	MAIN FRAME ID =	85
86	86	124	MAIN FRAME ID =	86
87	87	124	MAIN FRAME ID =	87
88	88	124	MAIN FRAME ID =	88
89	89	124	MAIN FRAME ID =	89
90	90	124	MAIN FRAME ID =	90
91	91	124	MAIN FRAME ID =	91
92	92	124	MAIN FRAME ID =	92
93	93	124	MAIN FRAME ID =	93
94	94	124	MAIN FRAME ID =	94
95	95	124	MAIN FRAME ID =	95
96	96	124	MAIN FRAME ID =	96
97	97	124	MAIN FRAME ID =	97
98	98	124	MAIN FRAME ID =	98
99	99	124	MAIN FRAME ID =	99
100	100	124	MAIN FRAME ID =	100
101	101	124	MAIN FRAME ID =	101
102	102	124	MAIN FRAME ID =	102
103	103	124	MAIN FRAME ID =	103
104	104	124	MAIN FRAME ID =	104
105	105	124	MAIN FRAME ID =	105
106	106	124	MAIN FRAME ID =	106
107	107	124	MAIN FRAME ID =	107

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108	108	124	MAIN	FRAME	ID	=	108
109	109	124	MAIN	FRAME	ID	=	109
110	110	124	MAIN	FRAME	ID	=	110
111	111	124	MAIN	FRAME	ID	=	111
112	112	124	MAIN	FRAME	ID	=	112
113	113	124	MAIN	FRAME	ID	=	113
114	114	124	MAIN	FRAME	ID	=	114
115	115	124	MAIN	FRAME	ID	=	115
116	116	124	MAIN	FRAME	ID	=	116
117	117	124	MAIN	FRAME	ID	=	117
118	118	124	MAIN	FRAME	ID	=	118
119	119	124	MAIN	FRAME	ID	=	119
120	120	124	MAIN	FRAME	ID	=	120
121	121	124	MAIN	FRAME	ID	=	121
122	122	124	MAIN	FRAME	ID	=	122
123	123	124	MAIN	FRAME	ID	=	123
124	124	124	MAIN	FRAME	ID	=	124
125	125	124	MAIN	FRAME	ID	=	125
126	126	124	MAIN	FRAME	ID	=	126
127	127	124	MAIN	FRAME	ID	=	127
128	0	3	VTCW	3			
129	0	2	VTCW	2			
130	0	1	VTCW	1			
131	0	0	VTCW	0			
132	8	3	VTCW	3			
133	8	2	VTCW	2			
134	8	1	VTCW	1			
135	8	0	VTCW	0			
136	16	3	VTCW	3			
137	16	2	VTCW	2			
138	16	1	VTCW	1			
139	16	0	VTCW	0			
140	24	3	VTCW	3			
141	24	2	VTCW	2			
142	24	1	VTCW	1			
143	24	0	VTCW	0			
144	32	3	VTCW	3			
145	32	2	VTCW	2			
146	32	1	VTCW	1			
147	32	0	VTCW	0			
148	40	3	VTCW	3			
149	40	2	VTCW	2			
150	40	1	VTCW	1			
151	40	0	VTCW	0			
152	48	3	VTCW	3			
153	48	2	VTCW	2			
154	48	1	VTCW	1			
155	48	0	VTCW	0			
156	56	3	VTCW	3			
157	56	2	VTCW	2			
158	56	1	VTCW	1			
159	56	0	VTCW	0			
160	64	3	VTCW	3			
161	64	2	VTCW	2			
162	64	1	VTCW	1			

163	64	0	VTCW	0
164	72	3	VTCW	3
165	72	2	VTCW	2
166	72	1	VTCW	1
167	72	0	VTCW	0
168	80	3	VTCW	3
169	80	2	VTCW	2
170	80	1	VTCW	1
171	80	0	VTCW	0
172	88	3	VTCW	3
173	88	2	VTCW	2
174	88	1	VTCW	1
175	88	0	VTCW	0
176	96	3	VTCW	3
177	96	2	VTCW	2
178	96	1	VTCW	1
179	96	0	VTCW	0
180	104	3	VTCW	3
181	104	2	VTCW	2
182	104	1	VTCW	1
183	104	0	VTCW	0
184	112	3	VTCW	3
185	112	2	VTCW	2
186	112	1	VTCW	1
187	112	0	VTCW	0
188	120	3	VTCW	3
189	120	2	VTCW	2
190	120	1	VTCW	1
191	120	0	VTCW	0
192	*	*	GROUND TIME	3
193	*	*	GROUND TIME	2
194	*	*	GROUND TIME	1
195	*	*	GROUND TIME	0
196	*	*	GROUND TIME	3
197	*	*	GROUND TIME	2
198	*	*	GROUND TIME	1
199	*	*	GROUND TIME	0
200	*	*	GROUND TIME	3
201	*	*	GROUND TIME	2
202	*	*	GROUND TIME	1
203	*	*	GROUND TIME	0
204	*	*	GROUND TIME	3
205	*	*	GROUND TIME	2
206	*	*	GROUND TIME	1
207	*	*	GROUND TIME	0
208	*	*	GROUND TIME	3
209	*	*	GROUND TIME	2
210	*	*	GROUND TIME	1
211	*	*	GROUND TIME	0
212	*	*	GROUND TIME	3
213	*	*	GROUND TIME	2
214	*	*	GROUND TIME	1
215	*	*	GROUND TIME	0
216	*	*	GROUND TIME	3
217	*	*	GROUND TIME	2
218	*	*	GROUND TIME	1

219	*	* GROUND TIME	0
220	*	* GROUND TIME	3
221	*	* GROUND TIME	2
222	*	* GROUND TIME	1
223	*	* GROUND TIME	0
224	*	* GROUND TIME	3
225	*	* GROUND TIME	2
226	*	* GROUND TIME	1
227	*	* GROUND TIME	0
228	*	* GROUND TIME	3
229	*	* GROUND TIME	2
230	*	* GROUND TIME	1
231	*	* GROUND TIME	0
232	*	* GROUND TIME	3
233	*	* GROUND TIME	2
234	*	* GROUND TIME	1
235	*	* GROUND TIME	0
236	*	* GROUND TIME	3
237	*	* GROUND TIME	2
238	*	* GROUND TIME	1
239	*	* GROUND TIME	0
240	*	* GROUND TIME	3
241	*	* GROUND TIME	2
242	*	* GROUND TIME	1
243	*	* GROUND TIME	0
244	*	* GROUND TIME	3
245	*	* GROUND TIME	2
246	*	* GROUND TIME	1
247	*	* GROUND TIME	0
248	*	* GROUND TIME	3
249	*	* GROUND TIME	2
250	*	* GROUND TIME	1
251	*	* GROUND TIME	0
252	*	* GROUND TIME	3
253	*	* GROUND TIME	2
254	*	* GROUND TIME	1
255	*	* GROUND TIME	0
256	0	105 NS ELEC LOW BYTE	
257	0	104 NS ELEC HIGH BYTE	
258	2	105 NS ELEC LOW BYTE	
259	2	104 NS ELEC HIGH BYTE	
260	4	105 NS ELEC LOW BYTE	
261	4	104 NS ELEC HIGH BYTE	
262	6	105 NS ELEC LOW BYTE	
263	6	104 NS ELEC HIGH BYTE	
264	8	105 NS ELEC LOW BYTE	
265	8	104 NS ELEC HIGH BYTE	
266	10	105 NS ELEC LOW BYTE	
267	10	104 NS ELEC HIGH BYTE	
268	12	105 NS ELEC LOW BYTE	
269	12	104 NS ELEC HIGH BYTE	
270	14	105 NS ELEC LOW BYTE	
271	14	104 NS ELEC HIGH BYTE	
272	16	105 NS ELEC LOW BYTE	
273	16	104 NS ELEC HIGH BYTE	
274	18	105 NS ELEC LOW BYTE	

275	18	104	NS	ELEC	HIGH	BYTE
276	20	105	NS	ELEC	LOW	BYTE
277	20	104	NS	ELEC	HIGH	BYTE
278	22	105	NS	ELEC	LOW	BYTE
279	22	104	NS	ELEC	HIGH	BYTE
280	24	105	NS	ELEC	LOW	BYTE
281	24	104	NS	ELEC	HIGH	BYTE
282	26	105	NS	ELEC	LOW	BYTE
283	26	104	NS	ELEC	HIGH	BYTE
284	28	105	NS	ELEC	LOW	BYTE
285	28	104	NS	ELEC	HIGH	BYTE
286	30	105	NS	ELEC	LOW	BYTE
287	30	104	NS	ELEC	HIGH	BYTE
288	32	105	NS	ELEC	LOW	BYTE
289	32	104	NS	ELEC	HIGH	BYTE
290	34	105	NS	ELEC	LOW	BYTE
291	34	104	NS	ELEC	HIGH	BYTE
292	36	105	NS	ELEC	LOW	BYTE
293	36	104	NS	ELEC	HIGH	BYTE
294	38	105	NS	ELEC	LOW	BYTE
295	38	104	NS	ELEC	HIGH	BYTE
296	40	105	NS	ELEC	LOW	BYTE
297	40	104	NS	ELEC	HIGH	BYTE
298	42	105	NS	ELEC	LOW	BYTE
299	42	104	NS	ELEC	HIGH	BYTE
300	44	105	NS	ELEC	LOW	BYTE
301	44	104	NS	ELEC	HIGH	BYTE
302	46	105	NS	ELEC	LOW	BYTE
303	46	104	NS	ELEC	HIGH	BYTE
304	48	105	NS	ELEC	LOW	BYTE
305	48	104	NS	ELEC	HIGH	BYTE
306	50	105	NS	ELEC	LOW	BYTE
307	50	104	NS	ELEC	HIGH	BYTE
308	52	105	NS	ELEC	LOW	BYTE
309	52	104	NS	ELEC	HIGH	BYTE
310	54	105	NS	ELEC	LOW	BYTE
311	54	104	NS	ELEC	HIGH	BYTE
312	56	105	NS	ELEC	LOW	BYTE
313	56	104	NS	ELEC	HIGH	BYTE
314	58	105	NS	ELEC	LOW	BYTE
315	58	104	NS	ELEC	HIGH	BYTE
316	60	105	NS	ELEC	LOW	BYTE
317	60	104	NS	ELEC	HIGH	BYTE
318	62	105	NS	ELEC	LOW	BYTE
319	62	104	NS	ELEC	HIGH	BYTE
320	64	105	NS	ELEC	LOW	BYTE
321	64	104	NS	ELEC	HIGH	BYTE
322	66	105	NS	ELEC	LOW	BYTE
323	66	104	NS	ELEC	HIGH	BYTE
324	68	105	NS	ELEC	LOW	BYTE
325	68	104	NS	ELEC	HIGH	BYTE
326	70	105	NS	ELEC	LOW	BYTE
327	70	104	NS	ELEC	HIGH	BYTE
328	72	105	NS	ELEC	LOW	BYTE
329	72	104	NS	ELEC	HIGH	BYTE
330	74	105	NS	ELEC	LOW	BYTE

331	74	104	NS	ELEC	HIGH	BYTE
332	76	105	NS	ELEC	LOW	BYTE
333	76	104	NS	ELEC	HIGH	BYTE
334	78	105	NS	ELEC	LOW	BYTE
335	78	104	NS	ELEC	HIGH	BYTE
336	80	105	NS	ELEC	LOW	BYTE
337	80	104	NS	ELEC	HIGH	BYTE
338	82	105	NS	ELEC	LOW	BYTE
339	82	104	NS	ELEC	HIGH	BYTE
340	84	105	NS	ELEC	LOW	BYTE
341	84	104	NS	ELEC	HIGH	BYTE
342	86	105	NS	ELEC	LOW	BYTE
343	86	104	NS	ELEC	HIGH	BYTE
344	88	105	NS	ELEC	LOW	BYTE
345	88	104	NS	ELEC	HIGH	BYTE
346	90	105	NS	ELEC	LOW	BYTE
347	90	104	NS	ELEC	HIGH	BYTE
348	92	105	NS	ELEC	LOW	BYTE
349	92	104	NS	ELEC	HIGH	BYTE
350	94	105	NS	ELEC	LOW	BYTE
351	94	104	NS	ELEC	HIGH	BYTE
352	96	105	NS	ELEC	LOW	BYTE
353	96	104	NS	ELEC	HIGH	BYTE
354	98	105	NS	ELEC	LOW	BYTE
355	98	104	NS	ELEC	HIGH	BYTE
356	100	105	NS	ELEC	LOW	BYTE
357	100	104	NS	ELEC	HIGH	BYTE
358	102	105	NS	ELEC	LOW	BYTE
359	102	104	NS	ELEC	HIGH	BYTE
360	104	105	NS	ELEC	LOW	BYTE
361	104	104	NS	ELEC	HIGH	BYTE
362	106	105	NS	ELEC	LOW	BYTE
363	106	104	NS	ELEC	HIGH	BYTE
364	108	105	NS	ELEC	LOW	BYTE
365	108	104	NS	ELEC	HIGH	BYTE
366	110	105	NS	ELEC	LOW	BYTE
367	110	104	NS	ELEC	HIGH	BYTE
368	112	105	NS	ELEC	LOW	BYTE
369	112	104	NS	ELEC	HIGH	BYTE
370	114	105	NS	ELEC	LOW	BYTE
371	114	104	NS	ELEC	HIGH	BYTE
372	116	105	NS	ELEC	LOW	BYTE
373	116	104	NS	ELEC	HIGH	BYTE
374	118	105	NS	ELEC	LOW	BYTE
375	118	104	NS	ELEC	HIGH	BYTE
376	120	105	NS	ELEC	LOW	BYTE
377	120	104	NS	ELEC	HIGH	BYTE
378	122	105	NS	ELEC	LOW	BYTE
379	122	104	NS	ELEC	HIGH	BYTE
380	124	105	NS	ELEC	LOW	BYTE
381	124	104	NS	ELEC	HIGH	BYTE
382	126	105	NS	ELEC	LOW	BYTE
383	126	104	NS	ELEC	HIGH	BYTE
384	1	105	NS	IONS	LOW	BYTE
385	1	104	NS	IONS	HIGH	BYTE
386	3	105	NS	IONS	LOW	BYTE

367	3	104	NS IONS HIGH BYTE
368	5	105	NS IONS LOW BYTE
369	5	104	NS IONS HIGH BYTE
370	7	105	NS IONS LOW BYTE
371	7	104	NS IONS HIGH BYTE
372	9	105	NS IONS LOW BYTE
373	9	104	NS IONS HIGH BYTE
374	11	105	NS IONS LOW BYTE
375	11	104	NS IONS HIGH BYTE
376	13	105	NS IONS LOW BYTE
377	13	104	NS IONS HIGH BYTE
378	15	105	NS IONS LOW BYTE
379	15	104	NS IONS HIGH BYTE
400	17	105	NS IONS LOW BYTE
401	17	104	NS IONS HIGH BYTE
402	19	105	NS IONS LOW BYTE
403	19	104	NS IONS HIGH BYTE
404	21	105	NS IONS LOW BYTE
405	21	104	NS IONS HIGH BYTE
406	23	105	NS IONS LOW BYTE
407	23	104	NS IONS HIGH BYTE
408	25	105	NS IONS LOW BYTE
409	25	104	NS IONS HIGH BYTE
410	27	105	NS IONS LOW BYTE
411	27	104	NS IONS HIGH BYTE
412	29	105	NS IONS LOW BYTE
413	29	104	NS IONS HIGH BYTE
414	31	105	NS IONS LOW BYTE
415	31	104	NS IONS HIGH BYTE
416	33	105	NS IONS LOW BYTE
417	33	104	NS IONS HIGH BYTE
418	35	105	NS IONS LOW BYTE
419	35	104	NS IONS HIGH BYTE
420	37	105	NS IONS LOW BYTE
421	37	104	NS IONS HIGH BYTE
422	39	105	NS IONS LOW BYTE
423	39	104	NS IONS HIGH BYTE
424	41	105	NS IONS LOW BYTE
425	41	104	NS IONS HIGH BYTE
426	43	105	NS IONS LOW BYTE
427	43	104	NS IONS HIGH BYTE
428	45	105	NS IONS LOW BYTE
429	45	104	NS IONS HIGH BYTE
430	47	105	NS IONS LOW BYTE
431	47	104	NS IONS HIGH BYTE
432	49	105	NS IONS LOW BYTE
433	49	104	NS IONS HIGH BYTE
434	51	105	NS IONS LOW BYTE
435	51	104	NS IONS HIGH BYTE
436	53	105	NS IONS LOW BYTE
437	53	104	NS IONS HIGH BYTE
438	55	105	NS IONS LOW BYTE
439	55	104	NS IONS HIGH BYTE
440	57	105	NS IONS LOW BYTE
441	57	104	NS IONS HIGH BYTE
442	59	105	NS IONS LOW BYTE

443	59	104	NS	IONS	HIGH	BYTE
444	61	105	NS	IONS	LOW	BYTE
445	61	104	NS	IONS	HIGH	BYTE
446	63	105	NS	IONS	LOW	BYTE
447	63	104	NS	IONS	HIGH	BYTE
448	65	105	NS	IONS	LOW	BYTE
449	65	104	NS	IONS	HIGH	BYTE
450	67	105	NS	IONS	LOW	BYTE
451	67	104	NS	IONS	HIGH	BYTE
452	69	105	NS	IONS	LOW	BYTE
453	69	104	NS	IONS	HIGH	BYTE
454	71	105	NS	IONS	LOW	BYTE
455	71	104	NS	IONS	HIGH	BYTE
456	73	105	NS	IONS	LOW	BYTE
457	73	104	NS	IONS	HIGH	BYTE
458	75	105	NS	IONS	LOW	BYTE
459	75	104	NS	IONS	HIGH	BYTE
460	77	105	NS	IONS	LOW	BYTE
461	77	104	NS	IONS	HIGH	BYTE
462	79	105	NS	IONS	LOW	BYTE
463	79	104	NS	IONS	HIGH	BYTE
464	81	105	NS	IONS	LOW	BYTE
465	81	104	NS	IONS	HIGH	BYTE
466	83	105	NS	IONS	LOW	BYTE
467	83	104	NS	IONS	HIGH	BYTE
468	85	105	NS	IONS	LOW	BYTE
469	85	104	NS	IONS	HIGH	BYTE
470	87	105	NS	IONS	LOW	BYTE
471	87	104	NS	IONS	HIGH	BYTE
472	89	105	NS	IONS	LOW	BYTE
473	89	104	NS	IONS	HIGH	BYTE
474	91	105	NS	IONS	LOW	BYTE
475	91	104	NS	IONS	HIGH	BYTE
476	93	105	NS	IONS	LOW	BYTE
477	93	104	NS	IONS	HIGH	BYTE
478	95	105	NS	IONS	LOW	BYTE
479	95	104	NS	IONS	HIGH	BYTE
480	97	105	NS	IONS	LOW	BYTE
481	97	104	NS	IONS	HIGH	BYTE
482	99	105	NS	IONS	LOW	BYTE
483	99	104	NS	IONS	HIGH	BYTE
484	101	105	NS	IONS	LOW	BYTE
485	101	104	NS	IONS	HIGH	BYTE
486	103	105	NS	IONS	LOW	BYTE
487	103	104	NS	IONS	HIGH	BYTE
488	105	105	NS	IONS	LOW	BYTE
489	105	104	NS	IONS	HIGH	BYTE
490	107	105	NS	IONS	LOW	BYTE
491	107	104	NS	IONS	HIGH	BYTE
492	109	105	NS	IONS	LOW	BYTE
493	109	104	NS	IONS	HIGH	BYTE
494	111	105	NS	IONS	LOW	BYTE
495	111	104	NS	IONS	HIGH	BYTE
496	113	105	NS	IONS	LOW	BYTE
497	113	104	NS	IONS	HIGH	BYTE
498	115	105	NS	IONS	LOW	BYTE

499	115	104	NS	IONS	HIGH	BYTE
500	117	105	NS	IONS	LOW	BYTE
501	117	104	NS	IONS	HIGH	BYTE
502	119	105	NS	IONS	LOW	BYTE
503	119	104	NS	IONS	HIGH	BYTE
504	121	105	NS	IONS	LOW	BYTE
505	121	104	NS	IONS	HIGH	BYTE
506	123	105	NS	IONS	LOW	BYTE
507	123	104	NS	IONS	HIGH	BYTE
508	125	105	NS	IONS	LOW	BYTE
509	125	104	NS	IONS	HIGH	BYTE
510	127	105	NS	IONS	LOW	BYTE
511	127	104	NS	IONS	HIGH	BYTE
512	0	50	EW	ELEC	LOW	BYTE
513	0	49	EW	ELEC	HIGH	BYTE
514	2	50	EW	ELEC	LOW	BYTE
515	2	49	EW	ELEC	HIGH	BYTE
516	4	50	EW	ELEC	LOW	BYTE
517	4	49	EW	ELEC	HIGH	BYTE
518	6	50	EW	ELEC	LOW	BYTE
519	6	49	EW	ELEC	HIGH	BYTE
520	8	50	EW	ELEC	LOW	BYTE
521	8	49	EW	ELEC	HIGH	BYTE
522	10	50	EW	ELEC	LOW	BYTE
523	10	49	EW	ELEC	HIGH	BYTE
524	12	50	EW	ELEC	LOW	BYTE
525	12	49	EW	ELEC	HIGH	BYTE
526	14	50	EW	ELEC	LOW	BYTE
527	14	49	EW	ELEC	HIGH	BYTE
528	16	50	EW	ELEC	LOW	BYTE
529	16	49	EW	ELEC	HIGH	BYTE
530	18	50	EW	ELEC	LOW	BYTE
531	18	49	EW	ELEC	HIGH	BYTE
532	20	50	EW	ELEC	LOW	BYTE
533	20	49	EW	ELEC	HIGH	BYTE
534	22	50	EW	ELEC	LOW	BYTE
535	22	49	EW	ELEC	HIGH	BYTE
536	24	50	EW	ELEC	LOW	BYTE
537	24	49	EW	ELEC	HIGH	BYTE
538	26	50	EW	ELEC	LOW	BYTE
539	26	49	EW	ELEC	HIGH	BYTE
540	28	50	EW	ELEC	LOW	BYTE
541	28	49	EW	ELEC	HIGH	BYTE
542	30	50	EW	ELEC	LOW	BYTE
543	30	49	EW	ELEC	HIGH	BYTE
544	32	50	EW	ELEC	LOW	BYTE
545	32	49	EW	ELEC	HIGH	BYTE
546	34	50	EW	ELEC	LOW	BYTE
547	34	49	EW	ELEC	HIGH	BYTE
548	36	50	EW	ELEC	LOW	BYTE
549	36	49	EW	ELEC	HIGH	BYTE
550	38	50	EW	ELEC	LOW	BYTE
551	38	49	EW	ELEC	HIGH	BYTE
552	40	50	EW	ELEC	LOW	BYTE
553	40	49	EW	ELEC	HIGH	BYTE
554	42	50	EW	ELEC	LOW	BYTE

555	42	49	EW ELEC HIGH BYTE
556	44	50	EW ELEC LOW BYTE
557	44	49	EW ELEC HIGH BYTE
558	46	50	EW ELEC LOW BYTE
559	46	49	EW ELEC HIGH BYTE
560	48	50	EW ELEC LOW BYTE
561	48	49	EW ELEC HIGH BYTE
562	50	50	EW ELEC LOW BYTE
563	50	49	EW ELEC HIGH BYTE
564	52	50	EW ELEC LOW BYTE
565	52	49	EW ELEC HIGH BYTE
566	54	50	EW ELEC LOW BYTE
567	54	49	EW ELEC HIGH BYTE
568	56	50	EW ELEC LOW BYTE
569	56	49	EW ELEC HIGH BYTE
570	58	50	EW ELEC LOW BYTE
571	58	49	EW ELEC HIGH BYTE
572	60	50	EW ELEC LOW BYTE
573	60	49	EW ELEC HIGH BYTE
574	62	50	EW ELEC LOW BYTE
575	62	49	EW ELEC HIGH BYTE
576	64	50	EW ELEC LOW BYTE
577	64	49	EW ELEC HIGH BYTE
578	66	50	EW ELEC LOW BYTE
579	66	49	EW ELEC HIGH BYTE
580	68	50	EW ELEC LOW BYTE
581	68	49	EW ELEC HIGH BYTE
582	70	50	EW ELEC LOW BYTE
583	70	49	EW ELEC HIGH BYTE
584	72	50	EW ELEC LOW BYTE
585	72	49	EW ELEC HIGH BYTE
586	74	50	EW ELEC LOW BYTE
587	74	49	EW ELEC HIGH BYTE
588	76	50	EW ELEC LOW BYTE
589	76	49	EW ELEC HIGH BYTE
590	78	50	EW ELEC LOW BYTE
591	78	49	EW ELEC HIGH BYTE
592	80	50	EW ELEC LOW BYTE
593	80	49	EW ELEC HIGH BYTE
594	82	50	EW ELEC LOW BYTE
595	82	49	EW ELEC HIGH BYTE
596	84	50	EW ELEC LOW BYTE
597	84	49	EW ELEC HIGH BYTE
598	86	50	EW ELEC LOW BYTE
599	86	49	EW ELEC HIGH BYTE
600	88	50	EW ELEC LOW BYTE
601	88	49	EW ELEC HIGH BYTE
602	90	50	EW ELEC LOW BYTE
603	90	49	EW ELEC HIGH BYTE
604	92	50	EW ELEC LOW BYTE
605	92	49	EW ELEC HIGH BYTE
606	94	50	EW ELEC LOW BYTE
607	94	49	EW ELEC HIGH BYTE
608	96	50	EW ELEC LOW BYTE
609	96	49	EW ELEC HIGH BYTE

610	98	50	EW ELEC LOW BYTE
611	98	49	EW ELEC HIGH BYTE
612	100	50	EW ELEC LOW BYTE
613	100	49	EW ELEC HIGH BYTE
614	102	50	EW ELEC LOW BYTE
615	102	49	EW ELEC HIGH BYTE
616	104	50	EW ELEC LOW BYTE
617	104	49	EW ELEC HIGH BYTE
618	106	50	EW ELEC LOW BYTE
619	106	49	EW ELEC HIGH BYTE
620	108	50	EW ELEC LOW BYTE
621	108	49	EW ELEC HIGH BYTE
622	110	50	EW ELEC LOW BYTE
623	110	49	EW ELEC HIGH BYTE
624	112	50	EW ELEC LOW BYTE
625	112	49	EW ELEC HIGH BYTE
626	114	50	EW ELEC LOW BYTE
627	114	49	EW ELEC HIGH BYTE
628	116	50	EW ELEC LOW BYTE
629	116	49	EW ELEC HIGH BYTE
630	118	50	EW ELEC LOW BYTE
631	118	49	EW ELEC HIGH BYTE
632	120	50	EW ELEC LOW BYTE
633	120	49	EW ELEC HIGH BYTE
634	122	50	EW ELEC LOW BYTE
635	122	49	EW ELEC HIGH BYTE
636	124	50	EW ELEC LOW BYTE
637	124	49	EW ELEC HIGH BYTE
638	126	50	EW ELEC LOW BYTE
639	126	49	EW ELEC HIGH BYTE
640	1	50	EW IONS LOW BYTE
641	1	49	EW IONS HIGH BYTE
642	3	50	EW IONS LOW BYTE
643	3	49	EW IONS HIGH BYTE
644	5	50	EW IONS LOW BYTE
645	5	49	EW IONS HIGH BYTE
646	7	50	EW IONS LOW BYTE
647	7	49	EW IONS HIGH BYTE
648	9	50	EW IONS LOW BYTE
649	9	49	EW IONS HIGH BYTE
650	11	50	EW IONS LOW BYTE
651	11	49	EW IONS HIGH BYTE
652	13	50	EW IONS LOW BYTE
653	13	49	EW IONS HIGH BYTE
654	15	50	EW IONS LOW BYTE
655	15	49	EW IONS HIGH BYTE
656	17	50	EW IONS LOW BYTE
657	17	49	EW IONS HIGH BYTE
658	19	50	EW IONS LOW BYTE
659	19	49	EW IONS HIGH BYTE
660	21	50	EW IONS LOW BYTE
661	21	49	EW IONS HIGH BYTE
662	23	50	EW IONS LOW BYTE
663	23	49	EW IONS HIGH BYTE
664	25	50	EW IONS LOW BYTE
665	25	49	EW IONS HIGH BYTE

666	27	50	EW IONS LOW BYTE
667	27	49	EW IONS HIGH BYTE
668	29	50	EW IONS LOW BYTE
669	29	49	EW IONS HIGH BYTE
670	31	50	EW IONS LOW BYTE
671	31	49	EW IONS HIGH BYTE
672	33	50	EW IONS LOW BYTE
673	33	49	EW IONS HIGH BYTE
674	35	50	EW IONS LOW BYTE
675	35	49	EW IONS HIGH BYTE
676	37	50	EW IONS LOW BYTE
677	37	49	EW IONS HIGH BYTE
678	39	50	EW IONS LOW BYTE
679	39	49	EW IONS HIGH BYTE
680	41	50	EW IONS LOW BYTE
681	41	49	EW IONS HIGH BYTE
682	43	50	EW IONS LOW BYTE
683	43	49	EW IONS HIGH BYTE
684	45	50	EW IONS LOW BYTE
685	45	49	EW IONS HIGH BYTE
686	47	50	EW IONS LOW BYTE
687	47	49	EW IONS HIGH BYTE
688	49	50	EW IONS LOW BYTE
689	49	49	EW IONS HIGH BYTE
690	51	50	EW IONS LOW BYTE
691	51	49	EW IONS HIGH BYTE
692	53	50	EW IONS LOW BYTE
693	53	49	EW IONS HIGH BYTE
694	55	50	EW IONS LOW BYTE
695	55	49	EW IONS HIGH BYTE
696	57	50	EW IONS LOW BYTE
697	57	49	EW IONS HIGH BYTE
698	59	50	EW IONS LOW BYTE
699	59	49	EW IONS HIGH BYTE
700	61	50	EW IONS LOW BYTE
701	61	49	EW IONS HIGH BYTE
702	63	50	EW IONS LOW BYTE
703	63	49	EW IONS HIGH BYTE
704	65	50	EW IONS LOW BYTE
705	65	49	EW IONS HIGH BYTE
706	67	50	EW IONS LOW BYTE
707	67	49	EW IONS HIGH BYTE
708	69	50	EW IONS LOW BYTE
709	69	49	EW IONS HIGH BYTE
710	71	50	EW IONS LOW BYTE
711	71	49	EW IONS HIGH BYTE
712	73	50	EW IONS LOW BYTE
713	73	49	EW IONS HIGH BYTE
714	75	50	EW IONS LOW BYTE
715	75	49	EW IONS HIGH BYTE
716	77	50	EW IONS LOW BYTE
717	77	49	EW IONS HIGH BYTE
718	79	50	EW IONS LOW BYTE
719	79	49	EW IONS HIGH BYTE
720	81	50	EW IONS LOW BYTE
721	81	49	EW IONS HIGH BYTE

722	83	50	EW	IONS	LOW	BYTE
723	83	49	EW	IONS	HIGH	BYTE
724	85	50	EW	IONS	LOW	BYTE
725	85	49	EW	IONS	HIGH	BYTE
726	87	50	EW	IONS	LOW	BYTE
727	87	49	EW	IONS	HIGH	BYTE
728	89	50	EW	IONS	LOW	BYTE
729	89	49	EW	IONS	HIGH	BYTE
730	91	50	EW	IONS	LOW	BYTE
731	91	49	EW	IONS	HIGH	BYTE
732	93	50	EW	IONS	LOW	BYTE
733	93	49	EW	IONS	HIGH	BYTE
734	95	50	EW	IONS	LOW	BYTE
735	95	49	EW	IONS	HIGH	BYTE
736	97	50	EW	IONS	LOW	BYTE
737	97	49	EW	IONS	HIGH	BYTE
738	99	50	EW	IONS	LOW	BYTE
739	99	49	EW	IONS	HIGH	BYTE
740	101	50	EW	IONS	LOW	BYTE
741	101	49	EW	IONS	HIGH	BYTE
742	103	50	EW	IONS	LOW	BYTE
743	103	49	EW	IONS	HIGH	BYTE
744	105	50	EW	IONS	LOW	BYTE
745	105	49	EW	IONS	HIGH	BYTE
746	107	50	EW	IONS	LOW	BYTE
747	107	49	EW	IONS	HIGH	BYTE
748	109	50	EW	IONS	LOW	BYTE
749	109	49	EW	IONS	HIGH	BYTE
750	111	50	EW	IONS	LOW	BYTE
751	111	49	EW	IONS	HIGH	BYTE
752	113	50	EW	IONS	LOW	BYTE
753	113	49	EW	IONS	HIGH	BYTE
754	115	50	EW	IONS	LOW	BYTE
755	115	49	EW	IONS	HIGH	BYTE
756	117	50	EW	IONS	LOW	BYTE
757	117	49	EW	IONS	HIGH	BYTE
758	119	50	EW	IONS	LOW	BYTE
759	119	49	EW	IONS	HIGH	BYTE
760	121	50	EW	IONS	LOW	BYTE
761	121	49	EW	IONS	HIGH	BYTE
762	123	50	EW	IONS	LOW	BYTE
763	123	49	EW	IONS	HIGH	BYTE
764	125	50	EW	IONS	LOW	BYTE
765	125	49	EW	IONS	HIGH	BYTE
766	127	50	EW	IONS	LOW	BYTE
767	127	49	EW	IONS	HIGH	BYTE
768	0	52	FD	IONS	LOW	BYTE
769	0	51	FD	IONS	HIGH	BYTE
770	1	52	FD	IONS	LOW	BYTE
771	1	51	FD	IONS	HIGH	BYTE
772	2	52	FD	IONS	LOW	BYTE
773	2	51	FD	IONS	HIGH	BYTE
774	3	52	FD	IONS	LOW	BYTE
775	3	51	FD	IONS	HIGH	BYTE
776	4	52	FD	IONS	LOW	BYTE
777	4	51	FD	IONS	HIGH	BYTE

778	5	52	FD	IONS	LOW	BYTE
779	5	51	FD	IONS	HIGH	BYTE
780	6	52	FD	IONS	LOW	BYTE
781	6	51	FD	IONS	HIGH	BYTE
782	7	52	FD	IONS	LOW	BYTE
783	7	51	FD	IONS	HIGH	BYTE
784	8	52	FD	IONS	LOW	BYTE
785	8	51	FD	IONS	HIGH	BYTE
786	9	52	FD	IONS	LOW	BYTE
787	9	51	FD	IONS	HIGH	BYTE
788	10	52	FD	IONS	LOW	BYTE
789	10	51	FD	IONS	HIGH	BYTE
790	11	52	FD	IONS	LOW	BYTE
791	11	51	FD	IONS	HIGH	BYTE
792	12	52	FD	IONS	LOW	BYTE
793	12	51	FD	IONS	HIGH	BYTE
794	13	52	FD	IONS	LOW	BYTE
795	13	51	FD	IONS	HIGH	BYTE
796	14	52	FD	IONS	LOW	BYTE
797	14	51	FD	IONS	HIGH	BYTE
798	15	52	FD	IONS	LOW	BYTE
799	15	51	FD	IONS	HIGH	BYTE
800	16	52	FD	IONS	LOW	BYTE
801	16	51	FD	IONS	HIGH	BYTE
802	17	52	FD	IONS	LOW	BYTE
803	17	51	FD	IONS	HIGH	BYTE
804	18	52	FD	IONS	LOW	BYTE
805	18	51	FD	IONS	HIGH	BYTE
806	19	52	FD	IONS	LOW	BYTE
807	19	51	FD	IONS	HIGH	BYTE
808	20	52	FD	IONS	LOW	BYTE
809	20	51	FD	IONS	HIGH	BYTE
810	21	52	FD	IONS	LOW	BYTE
811	21	51	FD	IONS	HIGH	BYTE
812	22	52	FD	IONS	LOW	BYTE
813	22	51	FD	IONS	HIGH	BYTE
814	23	52	FD	IONS	LOW	BYTE
815	23	51	FD	IONS	HIGH	BYTE
816	24	52	FD	IONS	LOW	BYTE
817	24	51	FD	IONS	HIGH	BYTE
818	25	52	FD	IONS	LOW	BYTE
819	25	51	FD	IONS	HIGH	BYTE
820	26	52	FD	IONS	LOW	BYTE
821	26	51	FD	IONS	HIGH	BYTE
822	27	52	FD	IONS	LOW	BYTE
823	27	51	FD	IONS	HIGH	BYTE
824	28	52	FD	IONS	LOW	BYTE
825	28	51	FD	IONS	HIGH	BYTE
826	29	52	FD	IONS	LOW	BYTE
827	29	51	FD	IONS	HIGH	BYTE
828	30	52	FD	IONS	LOW	BYTE
829	30	51	FD	IONS	HIGH	BYTE
830	31	52	FD	IONS	LOW	BYTE
831	31	51	FD	IONS	HIGH	BYTE

832	32	52	FD	IONS	LOW	BYTE
833	32	51	FD	IONS	HIGH	BYTE
834	33	52	FD	IONS	LOW	BYTE
835	33	51	FD	IONS	HIGH	BYTE
836	34	52	FD	IONS	LOW	BYTE
837	34	51	FD	IONS	HIGH	BYTE
838	35	52	FD	IONS	LOW	BYTE
839	35	51	FD	IONS	HIGH	BYTE
840	36	52	FD	IONS	LOW	BYTE
841	36	51	FD	IONS	HIGH	BYTE
842	37	52	FD	IONS	LOW	BYTE
843	37	51	FD	IONS	HIGH	BYTE
844	38	52	FD	IONS	LOW	BYTE
845	38	51	FD	IONS	HIGH	BYTE
846	39	52	FD	IONS	LOW	BYTE
847	39	51	FD	IONS	HIGH	BYTE
848	40	52	FD	IONS	LOW	BYTE
849	40	51	FD	IONS	HIGH	BYTE
850	41	52	FD	IONS	LOW	BYTE
851	41	51	FD	IONS	HIGH	BYTE
852	42	52	FD	IONS	LOW	BYTE
853	42	51	FD	IONS	HIGH	BYTE
854	43	52	FD	IONS	LOW	BYTE
855	43	51	FD	IONS	HIGH	BYTE
856	44	52	FD	IONS	LOW	BYTE
857	44	51	FD	IONS	HIGH	BYTE
858	45	52	FD	IONS	LOW	BYTE
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860	46	52	FD	IONS	LOW	BYTE
861	46	51	FD	IONS	HIGH	BYTE
862	47	52	FD	IONS	LOW	BYTE
863	47	51	FD	IONS	HIGH	BYTE
864	48	52	FD	IONS	LOW	BYTE
865	48	51	FD	IONS	HIGH	BYTE
866	49	52	FD	IONS	LOW	BYTE
867	49	51	FD	IONS	HIGH	BYTE
868	50	52	FD	IONS	LOW	BYTE
869	50	51	FD	IONS	HIGH	BYTE
870	51	52	FD	IONS	LOW	BYTE
871	51	51	FD	IONS	HIGH	BYTE
872	52	52	FD	IONS	LOW	BYTE
873	52	51	FD	IONS	HIGH	BYTE
874	53	52	FD	IONS	LOW	BYTE
875	53	51	FD	IONS	HIGH	BYTE
876	54	52	FD	IONS	LOW	BYTE
877	54	51	FD	IONS	HIGH	BYTE
878	55	52	FD	IONS	LOW	BYTE
879	55	51	FD	IONS	HIGH	BYTE
880	56	52	FD	IONS	LOW	BYTE
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883	57	51	FD	IONS	HIGH	BYTE
884	58	52	FD	IONS	LOW	BYTE
885	58	51	FD	IONS	HIGH	BYTE
886	59	52	FD	IONS	LOW	BYTE
887	59	51	FD	IONS	HIGH	BYTE

888	60	52	FD	IONS	LOW	BYTE
889	60	51	FD	IONS	HIGH	BYTE
890	61	52	FD	IONS	LOW	BYTE
891	61	51	FD	IONS	HIGH	BYTE
892	62	52	FD	IONS	LOW	BYTE
893	62	51	FD	IONS	HIGH	BYTE
894	63	52	FD	IONS	LOW	BYTE
895	63	51	FD	IONS	HIGH	BYTE
896	64	52	FD	IONS	LOW	BYTE
897	64	51	FD	IONS	HIGH	BYTE
898	65	52	FD	IONS	LOW	BYTE
899	65	51	FD	IONS	HIGH	BYTE
900	66	52	FD	IONS	LOW	BYTE
901	66	51	FD	IONS	HIGH	BYTE
902	67	52	FD	IONS	LOW	BYTE
903	67	51	FD	IONS	HIGH	BYTE
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905	68	51	FD	IONS	HIGH	BYTE
906	69	52	FD	IONS	LOW	BYTE
907	69	51	FD	IONS	HIGH	BYTE
908	70	52	FD	IONS	LOW	BYTE
909	70	51	FD	IONS	HIGH	BYTE
910	71	52	FD	IONS	LOW	BYTE
911	71	51	FD	IONS	HIGH	BYTE
912	72	52	FD	IONS	LOW	BYTE
913	72	51	FD	IONS	HIGH	BYTE
914	73	52	FD	IONS	LOW	BYTE
915	73	51	FD	IONS	HIGH	BYTE
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919	75	51	FD	IONS	HIGH	BYTE
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922	77	52	FD	IONS	LOW	BYTE
923	77	51	FD	IONS	HIGH	BYTE
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929	80	51	FD	IONS	HIGH	BYTE
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934	83	52	FD	IONS	LOW	BYTE
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939	85	51	FD	IONS	HIGH	BYTE
940	86	52	FD	IONS	LOW	BYTE
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942	87	52	FD	IONS	LOW	BYTE
943	87	51	FD	IONS	HIGH	BYTE

944	88	52	FD	IONS	LOW BYTE
945	88	51	FD	IONS	HIGH BYTE
946	89	52	FD	IONS	LOW BYTE
947	89	51	FD	IONS	HIGH BYTE
948	90	52	FD	IONS	LOW BYTE
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964	98	52	FD	IONS	LOW BYTE
965	98	51	FD	IONS	HIGH BYTE
966	99	52	FD	IONS	LOW BYTE
967	99	51	FD	IONS	HIGH BYTE
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969	100	51	FD	IONS	HIGH BYTE
970	101	52	FD	IONS	LOW BYTE
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975	103	51	FD	IONS	HIGH BYTE
976	104	52	FD	IONS	LOW BYTE
977	104	51	FD	IONS	HIGH BYTE
978	105	52	FD	IONS	LOW BYTE
979	105	51	FD	IONS	HIGH BYTE
980	106	52	FD	IONS	LOW BYTE
981	106	51	FD	IONS	HIGH BYTE
982	107	52	FD	IONS	LOW BYTE
983	107	51	FD	IONS	HIGH BYTE
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995	113	51	FD	IONS	HIGH BYTE
996	114	52	FD	IONS	LOW BYTE
997	114	51	FD	IONS	HIGH BYTE
998	115	52	FD	IONS	LOW BYTE
999	115	51	FD	IONS	HIGH BYTE

1000	116	52	FD IONS LOW BYTE
1001	116	51	FD IONS HIGH BYTE
1002	117	52	FD IONS LOW BYTE
1003	117	51	FD IONS HIGH BYTE
1004	118	52	FD IONS LOW BYTE
1005	118	51	FD IONS HIGH BYTE
1006	119	52	FD IONS LOW BYTE
1007	119	51	FD IONS HIGH BYTE
1008	120	52	FD IONS LOW BYTE
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1010	121	52	FD IONS LOW BYTE
1011	121	51	FD IONS HIGH BYTE
1012	122	52	FD IONS LOW BYTE
1013	122	51	FD IONS HIGH BYTE
1014	123	52	FD IONS LOW BYTE
1015	123	51	FD IONS HIGH BYTE
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1018	125	52	FD IONS LOW BYTE
1019	125	51	FD IONS HIGH BYTE
1020	126	52	FD IONS LOW BYTE
1021	126	51	FD IONS HIGH BYTE
1022	127	52	FD IONS LOW BYTE
1023	127	51	FD IONS HIGH BYTE
1024	1	64	MAGNETOMETER X - COARSE
1025	3	64	MAGNETOMETER X - COARSE
1026	5	64	MAGNETOMETER X - COARSE
1027	7	64	MAGNETOMETER X - COARSE
1028	9	64	MAGNETOMETER X - COARSE
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1036	25	64	MAGNETOMETER X - COARSE
1037	27	64	MAGNETOMETER X - COARSE
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1041	35	64	MAGNETOMETER X - COARSE
1042	37	64	MAGNETOMETER X - COARSE
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1051	55	64	MAGNETOMETER X - COARSE
1052	57	64	MAGNETOMETER X - COARSE
1053	59	64	MAGNETOMETER X - COARSE
1054	61	64	MAGNETOMETER X - COARSE

1055	63	64	MAGNETOMETER X - COARSE
1056	65	64	MAGNETOMETER X - COARSE
1057	67	64	MAGNETOMETER X - COARSE
1058	69	64	MAGNETOMETER X - COARSE
1059	71	64	MAGNETOMETER X - COARSE
1060	73	64	MAGNETOMETER X - COARSE
1061	75	64	MAGNETOMETER X - COARSE
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1075	103	64	MAGNETOMETER X - COARSE
1076	105	64	MAGNETOMETER X - COARSE
1077	107	64	MAGNETOMETER X - COARSE
1078	109	64	MAGNETOMETER X - COARSE
1079	111	64	MAGNETOMETER X - COARSE
1080	113	64	MAGNETOMETER X - COARSE
1081	115	64	MAGNETOMETER X - COARSE
1082	117	64	MAGNETOMETER X - COARSE
1083	119	64	MAGNETOMETER X - COARSE
1084	121	64	MAGNETOMETER X - COARSE
1085	123	64	MAGNETOMETER X - COARSE
1086	125	64	MAGNETOMETER X - COARSE
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1096	17	65	MAGNETOMETER X - FINE
1097	19	65	MAGNETOMETER X - FINE
1098	21	65	MAGNETOMETER X - FINE
1099	23	65	MAGNETOMETER X - FINE
1100	25	65	MAGNETOMETER X - FINE
1101	27	65	MAGNETOMETER X - FINE
1102	29	65	MAGNETOMETER X - FINE
1103	31	65	MAGNETOMETER X - FINE
1104	33	65	MAGNETOMETER X - FINE
1105	35	65	MAGNETOMETER X - FINE
1106	37	65	MAGNETOMETER X - FINE
1107	39	65	MAGNETOMETER X - FINE
1108	41	65	MAGNETOMETER X - FINE
1109	43	65	MAGNETOMETER X - FINE
1110	45	65	MAGNETOMETER X - FINE

1111	47	65	MAGNETOMETER X - FINE
1112	49	65	MAGNETOMETER X - FINE
1113	51	65	MAGNETOMETER X - FINE
1114	53	65	MAGNETOMETER X - FINE
1115	55	65	MAGNETOMETER X - FINE
1116	57	65	MAGNETOMETER X - FINE
1117	59	65	MAGNETOMETER X - FINE
1118	61	65	MAGNETOMETER X - FINE
1119	63	65	MAGNETOMETER X - FINE
1120	65	65	MAGNETOMETER X - FINE
1121	67	65	MAGNETOMETER X - FINE
1122	69	65	MAGNETOMETER X - FINE
1123	71	65	MAGNETOMETER X - FINE
1124	73	65	MAGNETOMETER X - FINE
1125	75	65	MAGNETOMETER X - FINE
1126	77	65	MAGNETOMETER X - FINE
1127	79	65	MAGNETOMETER X - FINE
1128	81	65	MAGNETOMETER X - FINE
1129	83	65	MAGNETOMETER X - FINE
1130	85	65	MAGNETOMETER X - FINE
1131	87	65	MAGNETOMETER X - FINE
1132	89	65	MAGNETOMETER X - FINE
1133	91	65	MAGNETOMETER X - FINE
1134	93	65	MAGNETOMETER X - FINE
1135	95	65	MAGNETOMETER X - FINE
1136	97	65	MAGNETOMETER X - FINE
1137	99	65	MAGNETOMETER X - FINE
1138	101	65	MAGNETOMETER X - FINE
1139	103	65	MAGNETOMETER X - FINE
1140	105	65	MAGNETOMETER X - FINE
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1142	109	65	MAGNETOMETER X - FINE
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1144	113	65	MAGNETOMETER X - FINE
1145	115	65	MAGNETOMETER X - FINE
1146	117	65	MAGNETOMETER X - FINE
1147	119	65	MAGNETOMETER X - FINE
1148	121	65	MAGNETOMETER X - FINE
1149	123	65	MAGNETOMETER X - FINE
1150	125	65	MAGNETOMETER X - FINE
1151	127	65	MAGNETOMETER X - FINE
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1161	19	66	MAGNETOMETER Y - COARSE
1162	21	66	MAGNETOMETER Y - COARSE
1163	23	66	MAGNETOMETER Y - COARSE
1164	25	66	MAGNETOMETER Y - COARSE
1165	27	66	MAGNETOMETER Y - COARSE
1166	29	66	MAGNETOMETER Y - COARSE

1167	31	66	MAGNETOMETER Y - COARSE
1168	33	66	MAGNETOMETER Y - COARSE
1169	35	66	MAGNETOMETER Y - COARSE
1170	37	66	MAGNETOMETER Y - COARSE
1171	39	66	MAGNETOMETER Y - COARSE
1172	41	66	MAGNETOMETER Y - COARSE
1173	43	66	MAGNETOMETER Y - COARSE
1174	45	66	MAGNETOMETER Y - COARSE
1175	47	66	MAGNETOMETER Y - COARSE
1176	49	66	MAGNETOMETER Y - COARSE
1177	51	66	MAGNETOMETER Y - COARSE
1178	53	66	MAGNETOMETER Y - COARSE
1179	55	66	MAGNETOMETER Y - COARSE
1180	57	66	MAGNETOMETER Y - COARSE
1181	59	66	MAGNETOMETER Y - COARSE
1182	61	66	MAGNETOMETER Y - COARSE
1183	63	66	MAGNETOMETER Y - COARSE
1184	65	66	MAGNETOMETER Y - COARSE
1185	67	66	MAGNETOMETER Y - COARSE
1186	69	66	MAGNETOMETER Y - COARSE
1187	71	66	MAGNETOMETER Y - COARSE
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1190	77	66	MAGNETOMETER Y - COARSE
1191	79	66	MAGNETOMETER Y - COARSE
1192	81	66	MAGNETOMETER Y - COARSE
1193	83	66	MAGNETOMETER Y - COARSE
1194	85	66	MAGNETOMETER Y - COARSE
1195	87	66	MAGNETOMETER Y - COARSE
1196	89	66	MAGNETOMETER Y - COARSE
1197	91	66	MAGNETOMETER Y - COARSE
1198	93	66	MAGNETOMETER Y - COARSE
1199	95	66	MAGNETOMETER Y - COARSE
1200	97	66	MAGNETOMETER Y - COARSE
1201	99	66	MAGNETOMETER Y - COARSE
1202	101	66	MAGNETOMETER Y - COARSE
1203	103	66	MAGNETOMETER Y - COARSE
1204	105	66	MAGNETOMETER Y - COARSE
14:45:19 LOGOUT USER [106,2] TT10:			
1205	107	66	MAGNETOMETER Y - COARSE
1206	109	66	MAGNETOMETER Y - COARSE
1207	111	66	MAGNETOMETER Y - COARSE
1208	113	66	MAGNETOMETER Y - COARSE
1209	115	66	MAGNETOMETER Y - COARSE
1210	117	66	MAGNETOMETER Y - COARSE
1211	119	66	MAGNETOMETER Y - COARSE
1212	121	66	MAGNETOMETER Y - COARSE
1213	123	66	MAGNETOMETER Y - COARSE
1214	125	66	MAGNETOMETER Y - COARSE
1215	127	66	MAGNETOMETER Y - COARSE
1216	1	67	MAGNETOMETER Y - FINE
1217	3	67	MAGNETOMETER Y - FINE
1218	5	67	MAGNETOMETER Y - FINE
1219	7	67	MAGNETOMETER Y - FINE
1220	9	67	MAGNETOMETER Y - FINE
1221	11	67	MAGNETOMETER Y - FINE
1222	13	67	MAGNETOMETER Y - FINE

1223	15	67	MAGNETOMETER Y - FINE
1224	17	67	MAGNETOMETER Y - FINE
1225	19	67	MAGNETOMETER Y - FINE
1226	21	67	MAGNETOMETER Y - FINE
1227	23	67	MAGNETOMETER Y - FINE
1228	25	67	MAGNETOMETER Y - FINE
1229	27	67	MAGNETOMETER Y - FINE
1230	29	67	MAGNETOMETER Y - FINE
1231	31	67	MAGNETOMETER Y - FINE
1232	33	67	MAGNETOMETER Y - FINE
1233	35	67	MAGNETOMETER Y - FINE
1234	37	67	MAGNETOMETER Y - FINE
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1236	41	67	MAGNETOMETER Y - FINE
1237	43	67	MAGNETOMETER Y - FINE
1238	45	67	MAGNETOMETER Y - FINE
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1251	71	67	MAGNETOMETER Y - FINE
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1254	77	67	MAGNETOMETER Y - FINE
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1259	87	67	MAGNETOMETER Y - FINE
1260	89	67	MAGNETOMETER Y - FINE
1261	91	67	MAGNETOMETER Y - FINE
1262	93	67	MAGNETOMETER Y - FINE
1263	95	67	MAGNETOMETER Y - FINE
1264	97	67	MAGNETOMETER Y - FINE
1265	99	67	MAGNETOMETER Y - FINE
1266	101	67	MAGNETOMETER Y - FINE
1267	103	67	MAGNETOMETER Y - FINE
1268	105	67	MAGNETOMETER Y - FINE
1269	107	67	MAGNETOMETER Y - FINE
1270	109	67	MAGNETOMETER Y - FINE
1271	111	67	MAGNETOMETER Y - FINE
1272	113	67	MAGNETOMETER Y - FINE
1273	115	67	MAGNETOMETER Y - FINE
1274	117	67	MAGNETOMETER Y - FINE
1275	119	67	MAGNETOMETER Y - FINE
1276	121	67	MAGNETOMETER Y - FINE
1277	123	67	MAGNETOMETER Y - FINE
1278	125	67	MAGNETOMETER Y - FINE
1279	127	67	MAGNETOMETER Y - FINE

1280	1	68	MAGNETOMETER	Z	- COARSE
1281	3	68	MAGNETOMETER	Z	- COARSE
1282	5	68	MAGNETOMETER	Z	- COARSE
1283	7	68	MAGNETOMETER	Z	- COARSE
1284	9	68	MAGNETOMETER	Z	- COARSE
1285	11	68	MAGNETOMETER	Z	- COARSE
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1294	29	68	MAGNETOMETER	Z	- COARSE
1295	31	68	MAGNETOMETER	Z	- COARSE
1296	33	68	MAGNETOMETER	Z	- COARSE
1297	35	68	MAGNETOMETER	Z	- COARSE
1298	37	68	MAGNETOMETER	Z	- COARSE
1299	39	68	MAGNETOMETER	Z	- COARSE
1300	41	68	MAGNETOMETER	Z	- COARSE
1301	43	68	MAGNETOMETER	Z	- COARSE
1302	45	68	MAGNETOMETER	Z	- COARSE
1303	47	68	MAGNETOMETER	Z	- COARSE
1304	49	68	MAGNETOMETER	Z	- COARSE
1305	51	68	MAGNETOMETER	Z	- COARSE
1306	53	68	MAGNETOMETER	Z	- COARSE
1307	55	68	MAGNETOMETER	Z	- COARSE
1308	57	68	MAGNETOMETER	Z	- COARSE
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1315	71	68	MAGNETOMETER	Z	- COARSE
1316	73	68	MAGNETOMETER	Z	- COARSE
1317	75	68	MAGNETOMETER	Z	- COARSE
1318	77	68	MAGNETOMETER	Z	- COARSE
1319	79	68	MAGNETOMETER	Z	- COARSE
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1322	85	68	MAGNETOMETER	Z	- COARSE
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1326	93	68	MAGNETOMETER	Z	- COARSE
1327	95	68	MAGNETOMETER	Z	- COARSE
1328	97	68	MAGNETOMETER	Z	- COARSE
1329	99	68	MAGNETOMETER	Z	- COARSE
1330	101	68	MAGNETOMETER	Z	- COARSE
1331	103	68	MAGNETOMETER	Z	- COARSE
1332	105	68	MAGNETOMETER	Z	- COARSE
1333	107	68	MAGNETOMETER	Z	- COARSE
1334	109	68	MAGNETOMETER	Z	- COARSE
1335	111	68	MAGNETOMETER	Z	- COARSE

1336	113	68	MAGNETOMETER Z - COARSE
1337	115	68	MAGNETOMETER Z - COARSE
1338	117	68	MAGNETOMETER Z - COARSE
1339	119	68	MAGNETOMETER Z - COARSE
1340	121	68	MAGNETOMETER Z - COARSE
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1342	125	68	MAGNETOMETER Z - COARSE
1343	127	68	MAGNETOMETER Z - COARSE
1344	1	69	MAGNETOMETER Z - FINE
1345	3	69	MAGNETOMETER Z - FINE
1346	5	69	MAGNETOMETER Z - FINE
1347	7	69	MAGNETOMETER Z - FINE
1348	9	69	MAGNETOMETER Z - FINE
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1350	13	69	MAGNETOMETER Z - FINE
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1371	55	69	MAGNETOMETER Z - FINE
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1373	59	69	MAGNETOMETER Z - FINE
1374	61	69	MAGNETOMETER Z - FINE
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1399	111	69	MAGNETOMETER Z - FINE
1400	113	69	MAGNETOMETER Z - FINE
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1423	121	73	MAGNETOMETER DIRECTION X
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1427	25	74	MAGNETOMETER DIRECTION Y
1428	33	74	MAGNETOMETER DIRECTION Y
1429	41	74	MAGNETOMETER DIRECTION Y
~~1430~~	~~49~~	~~74~~	~~MAGNETOMETER DIRECTION~~ Y
1431	57	74	MAGNETOMETER DIRECTION Y
1432	65	74	MAGNETOMETER DIRECTION Y
1433	73	74	MAGNETOMETER DIRECTION Y
1434	81	74	MAGNETOMETER DIRECTION Y
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1444	33	75	MAGNETOMETER DIRECTION Z
1445	41	75	MAGNETOMETER DIRECTION Z
1446	49	75	MAGNETOMETER DIRECTION Z
1447	57	75	MAGNETOMETER DIRECTION Z

1448	65	75	MAGNETOMETER DIRECTION Z
1449	73	75	MAGNETOMETER DIRECTION Z
1450	81	75	MAGNETOMETER DIRECTION Z
1451	89	75	MAGNETOMETER DIRECTION Z
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1454	113	75	MAGNETOMETER DIRECTION Z
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1456	107	102	+DVNS
1457	108	102	-DVNS
1458	109	102	+DVEW
1459	110	102	-DVEW
1460	111	102	+DVFD
1461	112	102	-DVFD
1462	113	102	SVNS
1463	114	102	SVEW
1464	115	102	SVFD
1465	116	102	TNS
1466	117	102	TEW
1467	118	102	TMB
1468	119	102	TPCU
1469	120	102	NS POS
1470	121	102	EW POS
1471	122	102	PCU MONITOR
1472	4	110	NS ANALOG POSITION
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1498	85	110	EW ANALOG POSITION
1499	93	110	EW ANALOG POSITION
1500	101	110	EW ANALOG POSITION
1501	109	110	EW ANALOG POSITION
1502	117	110	EW ANALOG POSITION
1503	125	110	EW ANALOG POSITION

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1509	16	36	PV1
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1511	24	36	PV1
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1575	112	103	MSB--<BCF1><BCF2><BCF3><BCF4><BCF5><BON><BDCF><BFF1>--LSB
1576	1	103	MSB--<BFF2><BEF1><BEF2><BEF3><BEF4><GCDF><BCSF><NBPF>--LSB
1577	17	103	MSB--<BFF2><BEF1><BEF2><BEF3><BEF4><GCDF><BCSF><NBPF>--LSB
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1581	81	103	MSB--<BFF2><BEF1><BEF2><BEF3><BEF4><GCDF><BCSF><NBPF>--LSB
1582	97	103	MSB--<BFF2><BEF1><BEF2><BEF3><BEF4><GCDF><BCSF><NBPF>--LSB
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1585	8	21	BEAM CURRENT HI
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1587	24	21	BEAM CURRENT HI
1588	32	21	BEAM CURRENT HI
1589	40	21	BEAM CURRENT HI
1590	48	21	BEAM CURRENT HI
1591	56	21	BEAM CURRENT HI
1592	64	21	BEAM CURRENT HI
1593	72	21	BEAM CURRENT HI
1594	80	21	BEAM CURRENT HI
1595	88	21	BEAM CURRENT HI
1596	96	21	BEAM CURRENT HI
1597	104	21	BEAM CURRENT HI
1598	112	21	BEAM CURRENT HI
1599	120	21	BEAM CURRENT HI
1600	0	22	BEAM CURRENT MONITOR
1601	8	22	BEAM CURRENT MONITOR
1602	16	22	BEAM CURRENT MONITOR
1603	24	22	BEAM CURRENT MONITOR
1604	32	22	BEAM CURRENT MONITOR
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1607	56	22	BEAM CURRENT MONITOR
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1609	72	22	BEAM CURRENT MONITOR
1610	80	22	BEAM CURRENT MONITOR
1611	88	22	BEAM CURRENT MONITOR
1612	96	22	BEAM CURRENT MONITOR
1613	104	22	BEAM CURRENT MONITOR
1614	112	22	BEAM CURRENT MONITOR
1615	120	22	BEAM CURRENT MONITOR

1616	0	23	NEUTRALIZER EMISSION
1617	8	23	NEUTRALIZER EMISSION
1618	16	23	NEUTRALIZER EMISSION
1619	24	23	NEUTRALIZER EMISSION
1620	32	23	NEUTRALIZER EMISSION
1621	40	23	NEUTRALIZER EMISSION
1622	48	23	NEUTRALIZER EMISSION
1623	56	23	NEUTRALIZER EMISSION
1624	64	23	NEUTRALIZER EMISSION
1625	72	23	NEUTRALIZER EMISSION
1626	80	23	NEUTRALIZER EMISSION
1627	88	23	NEUTRALIZER EMISSION
1628	96	23	NEUTRALIZER EMISSION
1629	104	23	NEUTRALIZER EMISSION
1630	112	23	NEUTRALIZER EMISSION
1631	120	23	NEUTRALIZER EMISSION
1632	0	24	SPIBS NEUT CURRENT MONITOR
1633	8	24	SPIBS NEUT CURRENT MONITOR
1634	16	24	SPIBS NEUT CURRENT MONITOR
1635	24	24	SPIBS NEUT CURRENT MONITOR
1636	32	24	SPIBS NEUT CURRENT MONITOR
1637	40	24	SPIBS NEUT CURRENT MONITOR
1638	48	24	SPIBS NEUT CURRENT MONITOR
1639	56	24	SPIBS NEUT CURRENT MONITOR
1640	64	24	SPIBS NEUT CURRENT MONITOR
1641	72	24	SPIBS NEUT CURRENT MONITOR
1642	80	24	SPIBS NEUT CURRENT MONITOR
1643	88	24	SPIBS NEUT CURRENT MONITOR
1644	96	24	SPIBS NEUT CURRENT MONITOR
1645	104	24	SPIBS NEUT CURRENT MONITOR
1646	112	24	SPIBS NEUT CURRENT MONITOR
1647	120	24	SPIBS NEUT CURRENT MONITOR
1648	4	112	DISCHARGE CURRENT
1649	20	112	DISCHARGE CURRENT
1650	36	112	DISCHARGE CURRENT
1651	52	112	DISCHARGE CURRENT
1652	68	112	DISCHARGE CURRENT
1653	84	112	DISCHARGE CURRENT
1654	100	112	DISCHARGE CURRENT
1655	116	112	DISCHARGE CURRENT
1656	55	102	HIGH VOLTAGE MONITOR
1657	56	102	VOLTAGE MONITOR 1
1658	57	102	VOLTAGE MONITOR 2
1659	60	102	BEAM VOLTAGE MONITOR
1660	63	102	KEEPER CURRENT MONITOR
1661	62	102	KEEPER HIGH VOLTAGE MONITOR
1662	71	102	ACCELERATOR CURRENT MONITOR
1663	72	102	DECELERATOR CURRENT MONITOR
1664	73	102	NEUTRALIZER HTR CURRENT MONITOR
1665	74	102	NEUTRALIZER BIAS VOLTAGE MONITOR
1666	12	103	NON CRITICAL BUS VOLTAGE
1667	28	103	NON CRITICAL BUS VOLTAGE
1668	44	103	NON CRITICAL BUS VOLTAGE
1669	60	103	NON CRITICAL BUS VOLTAGE
1670	76	103	NON CRITICAL BUS VOLTAGE
1671	92	103	NON CRITICAL BUS VOLTAGE

1672	108	103	NON CRITICAL BUS VOLTAGE
1673	124	103	NON CRITICAL BUS VOLTAGE
1674	1	108	NON CRITICAL BUS CURRENT #1
1675	17	108	NON CRITICAL BUS CURRENT #1
1676	33	108	NON CRITICAL BUS CURRENT #1
1677	49	108	NON CRITICAL BUS CURRENT #1
1678	65	108	NON CRITICAL BUS CURRENT #1
1679	81	108	NON CRITICAL BUS CURRENT #1
1680	97	108	NON CRITICAL BUS CURRENT #1
1681	113	108	NON CRITICAL BUS CURRENT #1
1682	2	108	NON CRITICAL BUS CURRENT #2
1683	18	108	NON CRITICAL BUS CURRENT #2
1684	34	108	NON CRITICAL BUS CURRENT #2
1685	50	108	NON CRITICAL BUS CURRENT #2
1686	66	108	NON CRITICAL BUS CURRENT #2
1687	82	108	NON CRITICAL BUS CURRENT #2
1688	98	108	NON CRITICAL BUS CURRENT #2
1689	114	108	NON CRITICAL BUS CURRENT #2
1690	43	42	SOLAR ARRAY TEMP #1
1691	44	42	SOLAR ARRAY TEMP #2
1692	56	42	SOLAR ARRAY TEMP #3
1693	46	42	SOLAR ARRAY TEMP #4
1694	2	109	SOLAR ARRAY CURRENT #1
1695	10	109	SOLAR ARRAY CURRENT #1
1696	18	109	SOLAR ARRAY CURRENT #1
1697	26	109	SOLAR ARRAY CURRENT #1
1698	34	109	SOLAR ARRAY CURRENT #1
1699	42	109	SOLAR ARRAY CURRENT #1
1700	50	109	SOLAR ARRAY CURRENT #1
1701	58	109	SOLAR ARRAY CURRENT #1
1702	66	109	SOLAR ARRAY CURRENT #1
1703	74	109	SOLAR ARRAY CURRENT #1
1704	82	109	SOLAR ARRAY CURRENT #1
1705	90	109	SOLAR ARRAY CURRENT #1
1706	98	109	SOLAR ARRAY CURRENT #1
1707	106	109	SOLAR ARRAY CURRENT #1
1708	114	109	SOLAR ARRAY CURRENT #1
1709	122	109	SOLAR ARRAY CURRENT #1
1710	2	110	SOLAR ARRAY CURRENT #2
1711	10	110	SOLAR ARRAY CURRENT #2
1712	18	110	SOLAR ARRAY CURRENT #2
1713	26	110	SOLAR ARRAY CURRENT #2
1714	34	110	SOLAR ARRAY CURRENT #2
1715	42	110	SOLAR ARRAY CURRENT #2
1716	50	110	SOLAR ARRAY CURRENT #2
1717	58	110	SOLAR ARRAY CURRENT #2
1718	66	110	SOLAR ARRAY CURRENT #2
1719	74	110	SOLAR ARRAY CURRENT #2
1720	82	110	SOLAR ARRAY CURRENT #2
1721	90	110	SOLAR ARRAY CURRENT #2
1722	98	110	SOLAR ARRAY CURRENT #2
1723	106	110	SOLAR ARRAY CURRENT #2
1724	114	110	SOLAR ARRAY CURRENT #2
1725	122	110	SOLAR ARRAY CURRENT #2
1726	47	42	SHUNT REGULATOR TEMP
1727	48	42	PCU TEMP 1

1728	0	106	STATUS	DCC
1729	2	106	STATUS	DCC
1730	4	106	STATUS	DCC
1731	6	106	STATUS	DCC
1732	8	106	STATUS	DCC
1733	10	106	STATUS	DCC
1734	12	106	STATUS	DCC
1735	14	106	STATUS	DCC
1736	16	106	STATUS	DCC
1737	18	106	STATUS	DCC
1738	20	106	STATUS	DCC
1739	22	106	STATUS	DCC
1740	24	106	STATUS	DCC
1741	26	106	STATUS	DCC
1742	28	106	STATUS	DCC
1743	30	106	STATUS	DCC
1744	32	106	STATUS	DCC
1745	34	106	STATUS	DCC
1746	36	106	STATUS	DCC
1747	38	106	STATUS	DCC
1748	40	106	STATUS	DCC
1749	42	106	STATUS	DCC
1750	44	106	STATUS	DCC
1751	46	106	STATUS	DCC
1752	48	106	STATUS	DCC
1753	50	106	STATUS	DCC
1754	52	106	STATUS	DCC
1755	54	106	STATUS	DCC
1756	56	106	STATUS	DCC
1757	58	106	STATUS	DCC
1758	60	106	STATUS	DCC
1759	62	106	STATUS	DCC
1760	64	106	STATUS	DCC
1761	66	106	STATUS	DCC
1762	68	106	STATUS	DCC
1763	70	106	STATUS	DCC
1764	72	106	STATUS	DCC
1765	74	106	STATUS	DCC
1766	76	106	STATUS	DCC
1767	78	106	STATUS	DCC
1768	80	106	STATUS	DCC
1769	82	106	STATUS	DCC
1770	84	106	STATUS	DCC
1771	86	106	STATUS	DCC
1772	88	106	STATUS	DCC
1773	90	106	STATUS	DCC
1774	92	106	STATUS	DCC
1775	94	106	STATUS	DCC
1776	96	106	STATUS	DCC
1777	98	106	STATUS	DCC
1778	100	106	STATUS	DCC
1779	102	106	STATUS	DCC
1780	104	106	STATUS	DCC
1781	106	106	STATUS	DCC
1782	108	106	STATUS	DCC
1783	110	106	STATUS	DCC

1784	112	106	STATUS	DCC
1785	114	106	STATUS	DCC
1786	116	106	STATUS	DCC
1787	118	106	STATUS	DCC
1788	120	106	STATUS	DCC
1789	122	106	STATUS	DCC
1790	124	106	STATUS	DCC
1791	126	106	STATUS	DCC
1792	1	106	STATUS	NSP
1793	5	106	STATUS	MSB-
1794	9	106	STATUS	NSP
1795	13	106	STATUS	MSB-
1796	17	106	STATUS	NSP
1797	21	106	STATUS	MSB-
1798	25	106	STATUS	NSP
1799	29	106	STATUS	MSB-
1800	33	106	STATUS	NSP
1801	37	106	STATUS	MSB-
1802	41	106	STATUS	NSP
1803	45	106	STATUS	MSB-
1804	49	106	STATUS	NSP
1805	53	106	STATUS	MSB-
1806	57	106	STATUS	NSP
1807	61	106	STATUS	MSB-
1808	65	106	STATUS	NSP
1809	69	106	STATUS	MSB-
1810	73	106	STATUS	NSP
1811	77	106	STATUS	MSB-
1812	81	106	STATUS	NSP
1813	85	106	STATUS	MSB-
1814	89	106	STATUS	NSP
1815	93	106	STATUS	MSB-
1816	97	106	STATUS	NSP
1817	101	106	STATUS	MSB-
1818	105	106	STATUS	NSP
1819	109	106	STATUS	MSB-
1820	113	106	STATUS	NSP
1821	117	106	STATUS	MSB-
1822	121	106	STATUS	NSP
1823	125	106	STATUS	MSB-
1824	3	106	STATUS	EWP
1825	5	106	STATUS	MSB-
1826	11	106	STATUS	EWP
1827	13	106	STATUS	MSB-
1828	19	106	STATUS	EWP
1829	21	106	STATUS	MSB-
1830	27	106	STATUS	EWP
1831	29	106	STATUS	MSB-
1832	35	106	STATUS	EWP
1833	37	106	STATUS	MSB-
1834	43	106	STATUS	EWP
1835	45	106	STATUS	MSB-
1836	51	106	STATUS	EWP
1837	53	106	STATUS	MSB-
1838	59	106	STATUS	EWP

NOTE: Odd numbered lines 1793-1856 have been slightly scrambeled on our tape. These lines should be filled with: MSB--<CCWEW>-<EWPB11>-<EWPB10>-<EWPB9>-<CCWNS>-<NSPB11>-<NSPB10>-<NSPB9>--LSB

1839	61	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1840	67	106	STATUS EWP
1841	69	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1842	75	106	STATUS EWP
1843	77	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1844	83	106	STATUS EWP
1845	85	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1846	91	106	STATUS EWP
1847	93	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1848	99	106	STATUS EWP
1849	101	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1850	107	106	STATUS EWP
1851	109	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1852	115	106	STATUS EWP
1853	117	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1854	123	106	STATUS EWP
1855	125	106	STATUS MSB--<0><0><0><0><CCWEW><EWPB11><EWPB10><EWPB9>--LSB
1856	7	106	STATUS NSLL
1857	15	106	STATUS NSUL
1858	23	106	STATUS EWLL
1859	31	106	STATUS EWUL
1860	39	106	STATUS NSPS
1861	47	106	STATUS EWPS
1862	55	106	STATUS DT
1863	63	106	STATUS DN
1864	71	106	STATUS ID1
1865	79	106	STATUS DSS
1866	87	106	STATUS AG
1867	95	106	STATUS MP
1868	103	106	STATUS LATCHING COMMANDS 1-7
1869	111	106	STATUS LATCHING COMMANDS 8-14
1870	119	106	STATUS MAGNITUDE COMMANDS 1-8
1871	127	106	STATUS MAGNITUDE COMMANDS 9-16
1872	3	109	ELECTRIC CHANNEL 1
1873	11	109	ELECTRIC CHANNEL 1
1874	19	109	ELECTRIC CHANNEL 1
1875	27	109	ELECTRIC CHANNEL 1
1876	35	109	ELECTRIC CHANNEL 1
1877	43	109	ELECTRIC CHANNEL 1
1878	51	109	ELECTRIC CHANNEL 1
1879	59	109	ELECTRIC CHANNEL 1
1880	67	109	ELECTRIC CHANNEL 1
1881	75	109	ELECTRIC CHANNEL 1
1882	83	109	ELECTRIC CHANNEL 1
1883	91	109	ELECTRIC CHANNEL 1
1884	99	109	ELECTRIC CHANNEL 1
1885	107	109	ELECTRIC CHANNEL 1
1886	115	109	ELECTRIC CHANNEL 1
1887	123	109	ELECTRIC CHANNEL 1
1888	3	110	ELECTRIC CHANNEL 2
1889	11	110	ELECTRIC CHANNEL 2
1890	19	110	ELECTRIC CHANNEL 2
1891	27	110	ELECTRIC CHANNEL 2
1892	35	110	ELECTRIC CHANNEL 2
1893	43	110	ELECTRIC CHANNEL 2

1894	51	110	ELECTRIC	CHANNEL	2
1895	59	110	ELECTRIC	CHANNEL	2
1896	67	110	ELECTRIC	CHANNEL	2
1897	75	110	ELECTRIC	CHANNEL	2
1898	83	110	ELECTRIC	CHANNEL	2
1899	91	110	ELECTRIC	CHANNEL	2
1900	99	110	ELECTRIC	CHANNEL	2
1901	107	110	ELECTRIC	CHANNEL	2
1902	115	110	ELECTRIC	CHANNEL	2
1903	123	110	ELECTRIC	CHANNEL	2
1904	3	111	ELECTRIC	CHANNEL	3
1905	11	111	ELECTRIC	CHANNEL	3
1906	19	111	ELECTRIC	CHANNEL	3
1907	27	111	ELECTRIC	CHANNEL	3
1908	35	111	ELECTRIC	CHANNEL	3
1909	43	111	ELECTRIC	CHANNEL	3
1910	51	111	ELECTRIC	CHANNEL	3
1911	59	111	ELECTRIC	CHANNEL	3
1912	67	111	ELECTRIC	CHANNEL	3
1913	75	111	ELECTRIC	CHANNEL	3
1914	83	111	ELECTRIC	CHANNEL	3
1915	91	111	ELECTRIC	CHANNEL	3
1916	99	111	ELECTRIC	CHANNEL	3
1917	107	111	ELECTRIC	CHANNEL	3
1918	115	111	ELECTRIC	CHANNEL	3
1919	123	111	ELECTRIC	CHANNEL	3
1920	3	112	ELECTRIC	CHANNEL	4
1921	11	112	ELECTRIC	CHANNEL	4
1922	19	112	ELECTRIC	CHANNEL	4
1923	27	112	ELECTRIC	CHANNEL	4
1924	35	112	ELECTRIC	CHANNEL	4
1925	43	112	ELECTRIC	CHANNEL	4
1926	51	112	ELECTRIC	CHANNEL	4
1927	59	112	ELECTRIC	CHANNEL	4
1928	67	112	ELECTRIC	CHANNEL	4
1929	75	112	ELECTRIC	CHANNEL	4
1930	83	112	ELECTRIC	CHANNEL	4
1931	91	112	ELECTRIC	CHANNEL	4
1932	99	112	ELECTRIC	CHANNEL	4
1933	107	112	ELECTRIC	CHANNEL	4
1934	115	112	ELECTRIC	CHANNEL	4
1935	123	112	ELECTRIC	CHANNEL	4
1936	3	113	MAGNETIC	CHANNEL	1
1937	11	113	MAGNETIC	CHANNEL	1
1938	19	113	MAGNETIC	CHANNEL	1
1939	27	113	MAGNETIC	CHANNEL	1
1940	35	113	MAGNETIC	CHANNEL	1
1941	43	113	MAGNETIC	CHANNEL	1
1942	51	113	MAGNETIC	CHANNEL	1
1943	59	113	MAGNETIC	CHANNEL	1
1944	67	113	MAGNETIC	CHANNEL	1
1945	75	113	MAGNETIC	CHANNEL	1
1946	83	113	MAGNETIC	CHANNEL	1
1947	91	113	MAGNETIC	CHANNEL	1
1948	99	113	MAGNETIC	CHANNEL	1
1949	107	113	MAGNETIC	CHANNEL	1

1950	115	113	MAGNETIC CHANNEL 1
1951	123	113	MAGNETIC CHANNEL 1
1952	3	114	MAGNETIC CHANNEL 2
1953	11	114	MAGNETIC CHANNEL 2
1954	19	114	MAGNETIC CHANNEL 2
1955	27	114	MAGNETIC CHANNEL 2
1956	35	114	MAGNETIC CHANNEL 2
1957	43	114	MAGNETIC CHANNEL 2
1958	51	114	MAGNETIC CHANNEL 2
1959	59	114	MAGNETIC CHANNEL 2
1960	67	114	MAGNETIC CHANNEL 2
1961	75	114	MAGNETIC CHANNEL 2
1962	83	114	MAGNETIC CHANNEL 2
1963	91	114	MAGNETIC CHANNEL 2
1964	99	114	MAGNETIC CHANNEL 2
1965	107	114	MAGNETIC CHANNEL 2
1966	115	114	MAGNETIC CHANNEL 2
1967	123	114	MAGNETIC CHANNEL 2
1968	3	115	MAGNETIC CHANNEL 3
1969	11	115	MAGNETIC CHANNEL 3
1970	19	115	MAGNETIC CHANNEL 3
1971	27	115	MAGNETIC CHANNEL 3
1972	35	115	MAGNETIC CHANNEL 3
1973	43	115	MAGNETIC CHANNEL 3
1974	51	115	MAGNETIC CHANNEL 3
1975	59	115	MAGNETIC CHANNEL 3
1976	67	115	MAGNETIC CHANNEL 3
1977	75	115	MAGNETIC CHANNEL 3
1978	83	115	MAGNETIC CHANNEL 3
1979	91	115	MAGNETIC CHANNEL 3
1980	99	115	MAGNETIC CHANNEL 3
1981	107	115	MAGNETIC CHANNEL 3
1982	115	115	MAGNETIC CHANNEL 3
1983	123	115	MAGNETIC CHANNEL 3
1984	3	116	MAGNETIC CHANNEL 4
1985	11	116	MAGNETIC CHANNEL 4
1986	19	116	MAGNETIC CHANNEL 4
1987	27	116	MAGNETIC CHANNEL 4
1988	35	116	MAGNETIC CHANNEL 4
1989	43	116	MAGNETIC CHANNEL 4
1990	51	116	MAGNETIC CHANNEL 4
1991	59	116	MAGNETIC CHANNEL 4
1992	67	116	MAGNETIC CHANNEL 4
1993	75	116	MAGNETIC CHANNEL 4
1994	83	116	MAGNETIC CHANNEL 4
1995	91	116	MAGNETIC CHANNEL 4
1996	99	116	MAGNETIC CHANNEL 4
1997	107	116	MAGNETIC CHANNEL 4
1998	115	116	MAGNETIC CHANNEL 4
1999	123	116	MAGNETIC CHANNEL 4
2000	5	103	MSB--<+CALV><-CALV><MODV><MODE><?><?><?><?>--LSB
2001	0	77	DSAS TIME TAG AND ANGLE LOW BYTE
2002	0	76	DSAS TIME TAG AND ANGLE MIDDLE BYTE
2003	0	75	DSAS TIME TAG AND ANGLE HIGH BYTE
2004	32	77	DSAS TIME TAG AND ANGLE LOW BYTE
2005	32	76	DSAS TIME TAG AND ANGLE MIDDLE BYTE

2006	32	75	DSAS TIME TAG AND ANGLE HIGH BYTE
2007	64	77	DSAS TIME TAG AND ANGLE LOW BYTE
2008	64	76	DSAS TIME TAG AND ANGLE MIDDLE BYTE
2009	64	75	DSAS TIME TAG AND ANGLE HIGH BYTE
2010	96	77	DSAS TIME TAG AND ANGLE LOW BYTE
2011	96	76	DSAS TIME TAG AND ANGLE MIDDLE BYTE
2012	96	75	DSAS TIME TAG AND ANGLE HIGH BYTE
2013	3	76	SC-10 COMMON MODE 1 (-)
2014	19	76	SC-10 (-) CM1
2015	35	76	SC-10 (-) CM1
2016	51	76	SC-10 (-) CM1
2017	67	76	SC-10 (-) CM1
2018	83	76	SC-10 (-) CM1
2019	99	76	SC-10 (-) CM1
2020	115	76	SC-10 (-) CM1
2021	3	77	SC-10 COMMON MODE 2 (-)
2022	19	77	SC-10 (-) CM2
2023	35	77	SC-10 (-) CM2
2024	51	77	SC-10 (-) CM2
2025	67	77	SC-10 (-) CM2
2026	83	77	SC-10 (-) CM2
2027	99	77	SC-10 (-) CM2
2028	115	77	SC-10 (-) CM2
2029	3	78	SC-10 COMMON MODE 3 (-)
2030	19	78	SC-10 (-) CM3
2031	35	78	SC-10 (-) CM3
2032	51	78	SC-10 (-) CM3
2033	67	78	SC-10 (-) CM3
2034	83	78	SC-10 (-) CM3
2035	99	78	SC-10 (-) CM3
2036	115	78	SC-10 (-) CM3
2037	3	108	SC-10 COMMON MODE 1 (+)
2038	19	108	SC-10 (+) CM1
2039	35	108	SC-10 (+) CM1
2040	51	108	SC-10 (+) CM1
2041	67	108	SC-10 (+) CM1
2042	83	108	SC-10 (+) CM1
2043	99	108	SC-10 (+) CM1
2044	115	108	SC-10 (+) CM1
2045	fill	0	
2046	fill	0	
2047	fill	0	

APPENDIX 7

COMMAND LIST

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

APPENDIX 7 COMMAND LIST

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7000	POWER ON	L#	020000246	00001	000000000	0000010100110	
	7001	POWER OFF	U#	020000266	00001	000000000	0000010110110	
	7002	NS DEFLECTION VOLTAGE INHIBIT	L#	020000001	00001	000000000	0000000000001	
	7003	EW DEFLECTION VOLTAGE INHIBIT	L#	020000101	00001	000000000	0000001000001	
	7004	FD DEFLECTION VOLTAGE INHIBIT	L#	020000301	00001	000000000	0000011000001	
	7005	UNLATCH CMDS 7002,7003,7004	U#	020000201	00001	000000000	0000010000001	
8	7011	NS SPIRALTRON VOLTAGE ON	L#	020000041	00001	000000000	0000000100001	LC 124-121
8	7012	EW SPIRALTRON VOLTAGE ON	L#	020000241	00001	000000000	0000010100001	LC 124-121
8	7013	FD SPIRALTRON VOLTAGE ON	L#	020000141	00001	000000000	0000001100001	LC 124-121
	7015	UNLATCH CMDS 7011,7012,7013	U#	020000261	00001	000000000	0000010110001	
	7020	PCU SPIRALTRON BIAS	L#	020000341	00001	000000000	0000011100001	
	7021	NS SPIRALTRON BIAS	L#	020000011	00001	000000000	0000000001001	
	7022	EW SPIRALTRON BIAS	L#	020000111	00001	000000000	0000001001001	
	7023	FD SPIRALTRON BIAS	L#	020000311	00001	000000000	0000011001001	
	7025	UNLATCH CMDS 7020,7021,7022,7023	U#	020000211	00001	000000000	0000010001001	
	7030	MOTOR POWER	L#	020000051	00001	000000000	0000000101001	
	7031	MOTOR VOLTAGE	L#	020000251	00001	000000000	0000010101001	
	7035	UNLATCH CMDS 7030,7031	U#	020000071	00001	000000000	0000000111001	
	7040	MICROPROCESSOR BYPASS	L#	020000151	00001	000000000	0000001101001	
	7041	MICROPROCESSOR OFF	L#	020000351	00001	000000000	0000011101001	
	7045	UNLATCH CMDS 7040,7041	U#	020000171	00001	000000000	0000001111001	
	7100	NSLL 1, REVERSAL ANGLE < -17.60 DEG	S	260000001	01011	000000000	0000000000001	J8510
	7101	NSLL 2, REVERSAL ANGLE < -16.21 DEG	S	260000002	01011	000000000	0000000000010	J8510
	7102	NSLL 3, REVERSAL ANGLE < -14.81 DEG	S	260000003	01011	000000000	0000000000011	J8510
	7103	NSLL 4, REVERSAL ANGLE < -13.42 DEG	S	260000004	01011	000000000	0000000000100	J8510
	7104	NSLL 5, REVERSAL ANGLE < -12.02 DEG	S	260000005	01011	000000000	0000000000101	J8510
	7105	NSLL 6, REVERSAL ANGLE < -10.63 DEG	S	260000006	01011	000000000	0000000000110	J8510
	7106	NSLL 7, REVERSAL ANGLE < -9.23 DEG	S	260000007	01011	000000000	0000000000111	J8510
	7107	NSLL 8, REVERSAL ANGLE < -7.84 DEG	S	260000010	01011	000000000	0000000001000	J8510
	7108	NSLL 9, REVERSAL ANGLE < -6.44 DEG	S	260000011	01011	000000000	0000000001001	J8510
	7109	NSLL 10, REVERSAL ANGLE < -5.05 DEG	S	260000012	01011	000000000	0000000001010	J8510
	7110	NSLL 11, REVERSAL ANGLE < -3.65 DEG	S	260000013	01011	000000000	0000000001011	J8510
	7111	NSLL 12, REVERSAL ANGLE < -2.26 DEG	S	260000014	01011	000000000	0000000001100	J8510
	7112	NSLL 13, REVERSAL ANGLE < -0.85 DEG	S	260000015	01011	000000000	0000000001101	J8510
	7113	NSLL 14, REVERSAL ANGLE < 0.53 DEG	S	260000016	01011	000000000	0000000001110	J8510
	7114	NSLL 15, REVERSAL ANGLE < 1.93 DEG	S	260000017	01011	000000000	0000000001111	J8510
	7115	NSLL 16, REVERSAL ANGLE < 3.33 DEG	S	260000020	01011	000000000	0000000010000	J8510
	7116	NSLL 17, REVERSAL ANGLE < 4.72 DEG	S	260000021	01011	000000000	0000000010001	J8510
	7117	NSLL 18, REVERSAL ANGLE < 6.12 DEG	S	260000022	01011	000000000	0000000010010	J8510
	7118	NSLL 19, REVERSAL ANGLE < 7.51 DEG	S	260000023	01011	000000000	0000000010011	J8510
	7119	NSLL 20, REVERSAL ANGLE < 8.91 DEG	S	260000024	01011	000000000	0000000010100	J8510
	7120	NSLL 21, REVERSAL ANGLE < 10.30 DEG	S	260000025	01011	000000000	0000000010101	J8510
	7121	NSLL 22, REVERSAL ANGLE < 11.70 DEG	S	260000026	01011	000000000	0000000010110	J8510
	7122	NSLL 23, REVERSAL ANGLE < 13.09 DEG	S	260000027	01011	000000000	0000000010111	J8510
	7123	NSLL 24, REVERSAL ANGLE < 14.49 DEG	S	260000030	01011	000000000	0000000011000	J8510
	7124	NSLL 25, REVERSAL ANGLE < 15.88 DEG	S	260000031	01011	000000000	0000000011001	J8510
	7125	NSLL 26, REVERSAL ANGLE < 17.26 DEG	S	260000032	01011	000000000	0000000011010	J8510
	7126	NSLL 27, REVERSAL ANGLE < 18.67 DEG	S	260000033	01011	000000000	0000000011011	J8510
	7127	NSLL 28, REVERSAL ANGLE < 20.07 DEG	S	260000034	01011	000000000	0000000011100	J8510
	7128	NSLL 29, REVERSAL ANGLE < 21.47 DEG	S	260000035	01011	000000000	0000000011101	J8510

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7129	NSLL 30, REVERSAL ANGLE < 22.86 DEG	S	260000036	01011	000000000	0000000011110	J8510
	7130	NSLL 31, REVERSAL ANGLE < 24.25 DEG	S	260000037	01011	000000000	0000000011111	J8510
	7131	NSLL 32, REVERSAL ANGLE < 25.65 DEG	S	260000040	01011	000000000	0000000100000	J8510
	7132	NSLL 33, REVERSAL ANGLE < 27.05 DEG	S	260000041	01011	000000000	0000000100001	J8510
	7133	NSLL 34, REVERSAL ANGLE < 28.44 DEG	S	260000042	01011	000000000	0000000100010	J8510
	7134	NSLL 35, REVERSAL ANGLE < 29.84 DEG	S	260000043	01011	000000000	0000000100011	J8510
	7135	NSLL 36, REVERSAL ANGLE < 31.23 DEG	S	260000044	01011	000000000	0000000100100	J8510
	7136	NSLL 37, REVERSAL ANGLE < 32.63 DEG	S	260000045	01011	000000000	0000000100101	J8510
	7137	NSLL 38, REVERSAL ANGLE < 34.02 DEG	S	260000046	01011	000000000	0000000100110	J8510
	7138	NSLL 39, REVERSAL ANGLE < 35.42 DEG	S	260000047	01011	000000000	0000000100111	J8510
	7139	NSLL 40, REVERSAL ANGLE < 36.81 DEG	S	260000050	01011	000000000	0000000101000	J8510
	7140	NSLL 41, REVERSAL ANGLE < 38.21 DEG	S	260000051	01011	000000000	0000000101001	J8510
	7141	NSLL 42, REVERSAL ANGLE < 39.60 DEG	S	260000052	01011	000000000	0000000101010	J8510
	7142	NSLL 43, REVERSAL ANGLE < 41.00 DEG	S	260000053	01011	000000000	0000000101011	J8510
	7143	NSLL 44, REVERSAL ANGLE < 42.40 DEG	S	260000054	01011	000000000	0000000101100	J8510
	7144	NSLL 45, REVERSAL ANGLE < 43.79 DEG	S	260000055	01011	000000000	0000000101101	J8510
	7145	NSLL 46, REVERSAL ANGLE < 45.19 DEG	S	260000056	01011	000000000	0000000101110	J8510
	7146	NSLL 47, REVERSAL ANGLE < 46.58 DEG	S	260000057	01011	000000000	0000000101111	J8510
	7147	NSLL 48, REVERSAL ANGLE < 47.98 DEG	S	260000060	01011	000000000	0000000110000	J8510
	7148	NSLL 49, REVERSAL ANGLE < 49.37 DEG	S	260000061	01011	000000000	0000000110001	J8510
	7149	NSLL 50, REVERSAL ANGLE < 50.77 DEG	S	260000062	01011	000000000	0000000110010	J8510
	7150	NSLL 51, REVERSAL ANGLE < 52.16 DEG	S	260000063	01011	000000000	0000000110011	J8510
	7151	NSLL 52, REVERSAL ANGLE < 53.56 DEG	S	260000064	01011	000000000	0000000110100	J8510
	7152	NSLL 53, REVERSAL ANGLE < 54.95 DEG	S	260000065	01011	000000000	0000000110101	J8510
	7153	NSLL 54, REVERSAL ANGLE < 56.35 DEG	S	260000066	01011	000000000	0000000110110	J8510
	7154	NSLL 55, REVERSAL ANGLE < 57.74 DEG	S	260000067	01011	000000000	0000000110111	J8510
	7155	NSLL 56, REVERSAL ANGLE < 59.14 DEG	S	260000070	01011	000000000	0000000111000	J8510
	7156	NSLL 57, REVERSAL ANGLE < 60.53 DEG	S	260000071	01011	000000000	0000000111001	J8510
	7157	NSLL 58, REVERSAL ANGLE < 61.93 DEG	S	260000072	01011	000000000	0000000111010	J8510
	7158	NSLL 59, REVERSAL ANGLE < 63.33 DEG	S	260000073	01011	000000000	0000000111011	J8510
	7159	NSLL 60, REVERSAL ANGLE < 64.72 DEG	S	260000074	01011	000000000	0000000111100	J8510
	7160	NSLL 61, REVERSAL ANGLE < 66.12 DEG	S	260000075	01011	000000000	0000000111101	J8510
	7161	NSLL 62, REVERSAL ANGLE < 67.51 DEG	S	260000076	01011	000000000	0000000111110	J8510
	7162	NSLL 63, REVERSAL ANGLE < 68.91 DEG	S	260000077	01011	000000000	0000000111111	J8510
	7163	NSLL 64, REVERSAL ANGLE < 70.30 DEG	S	260000100	01011	000000000	0000001000000	J8510
	7164	NSLL 65, REVERSAL ANGLE < 71.70 DEG	S	260000101	01011	000000000	0000001000001	J8510
	7165	NSLL 66, REVERSAL ANGLE < 73.09 DEG	S	260000102	01011	000000000	0000001000010	J8510
	7166	NSLL 67, REVERSAL ANGLE < 74.49 DEG	S	260000103	01011	000000000	0000001000011	J8510
	7167	NSLL 68, REVERSAL ANGLE < 75.88 DEG	S	260000104	01011	000000000	0000001000100	J8510
	7168	NSLL 69, REVERSAL ANGLE < 77.28 DEG	S	260000105	01011	000000000	0000001000101	J8510
	7169	NSLL 70, REVERSAL ANGLE < 78.67 DEG	S	260000106	01011	000000000	0000001000110	J8510
	7170	NSLL 71, REVERSAL ANGLE < 80.07 DEG	S	260000107	01011	000000000	0000001000111	J8510
	7171	NSLL 72, REVERSAL ANGLE < 81.47 DEG	S	260000110	01011	000000000	0000001001000	J8510
	7172	NSLL 73, REVERSAL ANGLE < 82.86 DEG	S	260000111	01011	000000000	0000001001001	J8510
	7173	NSLL 74, REVERSAL ANGLE < 84.23 DEG	S	260000112	01011	000000000	0000001001010	J8510
	7174	NSLL 75, REVERSAL ANGLE < 85.65 DEG	S	260000113	01011	000000000	0000001001011	J8510
	7175	NSLL 76, REVERSAL ANGLE < 87.05 DEG	S	260000114	01011	000000000	0000001001100	J8510
	7176	NSLL 77, REVERSAL ANGLE < 88.44 DEG	S	260000115	01011	000000000	0000001001101	J8510
	7177	NSLL 78, REVERSAL ANGLE < 89.84 DEG	S	260000116	01011	000000000	0000001001110	J8510
	7178	NSLL 79, REVERSAL ANGLE < 91.23 DEG	S	260000117	01011	000000000	0000001001111	J8510

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
7179	NSLL 80, REVERSAL ANGLE < 92.63 DEG	S	260000120	01011 000000000 000001010000	J8510
7180	NSLL 81, REVERSAL ANGLE < 94.02 DEG	S	260000121	01011 000000000 000001010001	J8510
7181	NSLL 82, REVERSAL ANGLE < 95.42 DEG	S	260000122	01011 000000000 000001010010	J8510
7182	NSLL 83, REVERSAL ANGLE < 96.81 DEG	S	260000123	01011 000000000 000001010011	J8510
7183	NSLL 84, REVERSAL ANGLE < 98.21 DEG	S	260000124	01011 000000000 000001010100	J8510
7184	NSLL 85, REVERSAL ANGLE < 99.60 DEG	S	260000125	01011 000000000 000001010101	J8510
7185	NSLL 86, REVERSAL ANGLE < 101.00 DEG	S	260000126	01011 000000000 000001010110	J8510
7186	NSLL 87, REVERSAL ANGLE < 102.40 DEG	S	260000127	01011 000000000 000001010111	J8510
7187	NSLL 88, REVERSAL ANGLE < 103.79 DEG	S	260000130	01011 000000000 000001011000	J8510
7188	NSLL 89, REVERSAL ANGLE < 105.19 DEG	S	260000131	01011 000000000 000001011001	J8510
7189	NSLL 90, REVERSAL ANGLE < 106.58 DEG	S	260000132	01011 000000000 000001011010	J8510
7190	NSLL 91, REVERSAL ANGLE < 107.98 DEG	S	260000133	01011 000000000 000001011011	J8510
7191	NSLL 92, REVERSAL ANGLE < 109.37 DEG	S	260000134	01011 000000000 000001011100	J8510
7192	NSLL 93, REVERSAL ANGLE < 110.77 DEG	S	260000135	01011 000000000 000001011101	J8510
7193	NSLL 94, REVERSAL ANGLE < 112.16 DEG	S	260000136	01011 000000000 000001011110	J8510
7194	NSLL 95, REVERSAL ANGLE < 113.56 DEG	S	260000137	01011 000000000 000001011111	J8510
7195	NSLL 96, REVERSAL ANGLE < 114.95 DEG	S	260000140	01011 000000000 000001100000	J8510
7196	NSLL 97, REVERSAL ANGLE < 116.35 DEG	S	260000141	01011 000000000 000001100001	J8510
7197	NSLL 98, REVERSAL ANGLE < 117.74 DEG	S	260000142	01011 000000000 000001100010	J8510
7198	NSLL 99, REVERSAL ANGLE < 119.14 DEG	S	260000143	01011 000000000 000001100011	J8510
7199	NSLL 100, REVERSAL ANGLE < 120.53 DEG	S	260000144	01011 000000000 000001100100	J8510
7200	NSLL 101, REVERSAL ANGLE < 121.93 DEG	S	260000145	01011 000000000 000001100101	J8510
7201	NSLL 102, REVERSAL ANGLE < 123.33 DEG	S	260000146	01011 000000000 000001100110	J8510
7202	NSLL 103, REVERSAL ANGLE < 124.72 DEG	S	260000147	01011 000000000 000001100111	J8510
7203	NSLL 104, REVERSAL ANGLE < 126.12 DEG	S	260000150	01011 000000000 000001101000	J8510
7204	NSLL 105, REVERSAL ANGLE < 127.51 DEG	S	260000151	01011 000000000 000001101001	J8510
7205	NSLL 106, REVERSAL ANGLE < 128.91 DEG	S	260000152	01011 000000000 000001101010	J8510
7206	NSLL 107, REVERSAL ANGLE < 130.30 DEG	S	260000153	01011 000000000 000001101011	J8510
7207	NSLL 108, REVERSAL ANGLE < 131.70 DEG	S	260000154	01011 000000000 000001101100	J8510
7208	NSLL 109, REVERSAL ANGLE < 133.09 DEG	S	260000155	01011 000000000 000001101101	J8510
7209	NSLL 110, REVERSAL ANGLE < 134.49 DEG	S	260000156	01011 000000000 000001101110	J8510
7210	NSLL 111, REVERSAL ANGLE < 135.88 DEG	S	260000157	01011 000000000 000001101111	J8510
7211	NSLL 112, REVERSAL ANGLE < 137.28 DEG	S	260000160	01011 000000000 000001110000	J8510
7212	NSLL 113, REVERSAL ANGLE < 138.67 DEG	S	260000161	01011 000000000 000001110001	J8510
7213	NSLL 114, REVERSAL ANGLE < 140.07 DEG	S	260000162	01011 000000000 000001110010	J8510
7214	NSLL 115, REVERSAL ANGLE < 141.47 DEG	S	260000163	01011 000000000 000001110011	J8510
7215	NSLL 116, REVERSAL ANGLE < 142.86 DEG	S	260000164	01011 000000000 000001110100	J8510
7216	NSLL 117, REVERSAL ANGLE < 144.26 DEG	S	260000165	01011 000000000 000001110101	J8510
7217	NSLL 118, REVERSAL ANGLE < 145.65 DEG	S	260000166	01011 000000000 000001110110	J8510
7218	NSLL 119, REVERSAL ANGLE < 147.05 DEG	S	260000167	01011 000000000 000001110111	J8510
7219	NSLL 120, REVERSAL ANGLE < 148.44 DEG	S	260000170	01011 000000000 000001111000	J8510
7220	NSLL 121, REVERSAL ANGLE < 149.84 DEG	S	260000171	01011 000000000 000001111001	J8510
7221	NSLL 122, REVERSAL ANGLE < 151.23 DEG	S	260000172	01011 000000000 000001111010	J8510
7222	NSLL 123, REVERSAL ANGLE < 152.63 DEG	S	260000173	01011 000000000 000001111011	J8510
7223	NSLL 124, REVERSAL ANGLE < 154.02 DEG	S	260000174	01011 000000000 000001111100	J8510
7224	NSLL 125, REVERSAL ANGLE < 155.42 DEG	S	260000175	01011 000000000 000001111101	J8510
7225	NSLL 126, REVERSAL ANGLE < 156.81 DEG	S	260000176	01011 000000000 000001111110	J8510
7226	NSLL 127, REVERSAL ANGLE < 158.21 DEG	S	260000177	01011 000000000 000001111111	J8510
7227	NSLL 128, REVERSAL ANGLE < 159.60 DEG	S	260000200	01011 000000000 000010000000	J8510
7228	NSLL 129, REVERSAL ANGLE < 161.00 DEG	S	260000201	01011 000000000 000010000001	J8510

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7229	NSLL 130, REVERSAL ANGLE < 162.40 DEG	S	260000202	01011	000000000	0000010000010	J8510
7230	NSLL 131, REVERSAL ANGLE < 163.79 DEG	S	260000203	01011	000000000	0000010000011	J8510
7231	NSLL 132, REVERSAL ANGLE < 165.19 DEG	S	260000204	01011	000000000	0000010000100	J8510
7232	NSLL 133, REVERSAL ANGLE < 166.58 DEG	S	260000205	01011	000000000	0000010000101	J8510
7233	NSLL 134, REVERSAL ANGLE < 167.98 DEG	S	260000206	01011	000000000	0000010000110	J8510
7234	NSLL 135, REVERSAL ANGLE < 169.37 DEG	S	260000207	01011	000000000	0000010000111	J8510
7235	NSLL 136, REVERSAL ANGLE < 170.77 DEG	S	260000210	01011	000000000	0000010001000	J8510
7236	NSLL 137, REVERSAL ANGLE < 172.16 DEG	S	260000211	01011	000000000	0000010001001	J8510
7237	NSLL 138, REVERSAL ANGLE < 173.56 DEG	S	260000212	01011	000000000	0000010001010	J8510
7238	NSLL 139, REVERSAL ANGLE < 174.95 DEG	S	260000213	01011	000000000	0000010001011	J8510
7239	NSLL 140, REVERSAL ANGLE < 176.35 DEG	S	260000214	01011	000000000	0000010001100	J8510
7240	NSLL 141, REVERSAL ANGLE < 177.74 DEG	S	260000215	01011	000000000	0000010001101	J8510
7241	NSLL 142, REVERSAL ANGLE < 179.14 DEG	S	260000216	01011	000000000	0000010001110	J8510
7242	NSLL 143, REVERSAL ANGLE < 180.53 DEG	S	260000217	01011	000000000	0000010001111	J8510
7243	NSLL 144, REVERSAL ANGLE < 181.93 DEG	S	260000220	01011	000000000	0000010010000	J8510
7244	NSLL 145, REVERSAL ANGLE < 183.33 DEG	S	260000221	01011	000000000	0000010010001	J8510
7245	NSLL 146, REVERSAL ANGLE < 184.72 DEG	S	260000222	01011	000000000	0000010010010	J8510
7246	NSLL 147, REVERSAL ANGLE < 186.12 DEG	S	260000223	01011	000000000	0000010010011	J8510
7247	NSLL 148, REVERSAL ANGLE < 187.51 DEG	S	260000224	01011	000000000	0000010010100	J8510
7248	NSLL 149, REVERSAL ANGLE < 188.91 DEG	S	260000225	01011	000000000	0000010010101	J8510
7249	NSLL 150, REVERSAL ANGLE < 190.30 DEG	S	260000226	01011	000000000	0000010010110	J8510
7250	NSLL 151, REVERSAL ANGLE < 191.70 DEG	S	260000227	01011	000000000	0000010010111	J8510
7251	NSLL 152, REVERSAL ANGLE < 193.09 DEG	S	260000230	01011	000000000	0000010011000	J8510
7252	NSLL 153, REVERSAL ANGLE < 194.49 DEG	S	260000231	01011	000000000	0000010011001	J8510
7253	NSLL 154, REVERSAL ANGLE < 195.88 DEG	S	260000232	01011	000000000	0000010011010	J8510
7254	NSLL 155, REVERSAL ANGLE < 197.28 DEG	S	260000233	01011	000000000	0000010011011	J8510
7255	NSLL 156, REVERSAL ANGLE < 198.67 DEG	S	260000234	01011	000000000	0000010011100	J8510
7256	NSLL 157, REVERSAL ANGLE < 200.07 DEG	S	260000235	01011	000000000	0000010011101	J8510
7257	NSLL 158, REVERSAL ANGLE < 201.47 DEG	S	260000236	01011	000000000	0000010011110	J8510
7258	NSLL 159, REVERSAL ANGLE < 202.86 DEG	S	260000237	01011	000000000	0000010011111	J8510
7259	NSLL 160, REVERSAL ANGLE < 204.26 DEG	S	260000240	01011	000000000	0000010100000	J8510
7260	NSLL 161, REVERSAL ANGLE < 205.65 DEG	S	260000241	01011	000000000	0000010100001	J8510
7261	NSLL 162, REVERSAL ANGLE < 207.05 DEG	S	260000242	01011	000000000	0000010100010	J8510
7262	NSLL 163, REVERSAL ANGLE < 208.44 DEG	S	260000243	01011	000000000	0000010100011	J8510
7263	NSLL 164, REVERSAL ANGLE < 209.84 DEG	S	260000244	01011	000000000	0000010100100	J8510
7264	NSLL 165, REVERSAL ANGLE < 211.23 DEG	S	260000245	01011	000000000	0000010100101	J8510
7265	NSLL 166, REVERSAL ANGLE < 212.63 DEG	S	260000246	01011	000000000	0000010100110	J8510
7266	NSLL 167, REVERSAL ANGLE < 214.02 DEG	S	260000247	01011	000000000	0000010100111	J8510
7267	NSLL 168, REVERSAL ANGLE < 215.42 DEG	S	260000250	01011	000000000	0000010101000	J8510
7268	NSLL 169, REVERSAL ANGLE < 216.81 DEG	S	260000251	01011	000000000	0000010101001	J8510
7269	NSLL 170, REVERSAL ANGLE < 218.21 DEG	S	260000252	01011	000000000	0000010101010	J8510
7270	NSLL 171, REVERSAL ANGLE < 219.60 DEG	S	260000253	01011	000000000	0000010101011	J8510
7271	NSLL 172, REVERSAL ANGLE < 221.00 DEG	S	260000254	01011	000000000	0000010101100	J8510
7272	NSLL 173, REVERSAL ANGLE < 222.40 DEG	S	260000255	01011	000000000	0000010101101	J8510
7273	NSLL 174, REVERSAL ANGLE < 223.79 DEG	S	260000256	01011	000000000	0000010101110	J8510
7274	NSLL 175, REVERSAL ANGLE < 225.19 DEG	S	260000257	01011	000000000	0000010101111	J8510
7275	NSLL 176, REVERSAL ANGLE < 226.58 DEG	S	260000260	01011	000000000	0000010110000	J8510
7276	NSLL 177, REVERSAL ANGLE < 227.98 DEG	S	260000261	01011	000000000	0000010110001	J8510
7277	NSLL 178, REVERSAL ANGLE < 229.37 DEG	S	260000262	01011	000000000	0000010110010	J8510
7278	NSLL 179, REVERSAL ANGLE < 230.77 DEG	S	260000263	01011	000000000	0000010110011	J8510

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P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7279	NSLL 180, REVERSAL ANGLE < 232.16 DEG	S	260000264	01011	000000000	0000010110100	J8510
	7280	NSLL 0, FORCED REVERSAL ANGLE	S	260000000	01011	000000000	0000000000000	J8510
	7281	NSLL 255, FORCED REVERSAL ANGLE	S	260000377	01011	000000000	0000011111111	J8510
	7282	NSUL 1, REVERSAL ANGLE > -17.60 DEG	S	260000401	01011	000000000	0000100000001	J8511
	7283	NSUL 2, REVERSAL ANGLE > -16.21 DEG	S	260000402	01011	000000000	0000100000010	J8511
	7284	NSUL 3, REVERSAL ANGLE > -14.81 DEG	S	260000403	01011	000000000	0000100000011	J8511
	7285	NSUL 4, REVERSAL ANGLE > -13.42 DEG	S	260000404	01011	000000000	0000100000100	J8511
	7286	NSUL 5, REVERSAL ANGLE > -12.02 DEG	S	260000405	01011	000000000	0000100000101	J8511
	7287	NSUL 6, REVERSAL ANGLE > -10.63 DEG	S	260000406	01011	000000000	0000100000110	J8511
	7288	NSUL 7, REVERSAL ANGLE > -9.23 DEG	S	260000407	01011	000000000	0000100000111	J8511
	7289	NSUL 8, REVERSAL ANGLE > -7.84 DEG	S	260000410	01011	000000000	0000100001000	J8511
	7290	NSUL 9, REVERSAL ANGLE > -6.44 DEG	S	260000411	01011	000000000	0000100001001	J8511
	7291	NSUL 10, REVERSAL ANGLE > -5.05 DEG	S	260000412	01011	000000000	0000100001010	J8511
	7292	NSUL 11, REVERSAL ANGLE > -3.65 DEG	S	260000413	01011	000000000	0000100001011	J8511
	7293	NSUL 12, REVERSAL ANGLE > -2.26 DEG	S	260000414	01011	000000000	0000100001100	J8511
	7294	NSUL 13, REVERSAL ANGLE > -0.86 DEG	S	260000415	01011	000000000	0000100001101	J8511
	7295	NSUL 14, REVERSAL ANGLE > 0.53 DEG	S	260000416	01011	000000000	0000100001110	J8511
	7296	NSUL 15, REVERSAL ANGLE > 1.93 DEG	S	260000417	01011	000000000	0000100001111	J8511
	7297	NSUL 16, REVERSAL ANGLE > 3.33 DEG	S	260000420	01011	000000000	0000100010000	J8511
	7298	NSUL 17, REVERSAL ANGLE > 4.72 DEG	S	260000421	01011	000000000	0000100010001	J8511
	7299	NSUL 18, REVERSAL ANGLE > 6.12 DEG	S	260000422	01011	000000000	0000100010010	J8511
	7300	NSUL 19, REVERSAL ANGLE > 7.51 DEG	S	260000423	01011	000000000	0000100010011	J8511
	7301	NSUL 20, REVERSAL ANGLE > 8.91 DEG	S	260000424	01011	000000000	0000100010100	J8511
	7302	NSUL 21, REVERSAL ANGLE > 10.30 DEG	S	260000425	01011	000000000	0000100010101	J8511
	7303	NSUL 22, REVERSAL ANGLE > 11.70 DEG	S	260000426	01011	000000000	0000100010110	J8511
	7304	NSUL 23, REVERSAL ANGLE > 13.09 DEG	S	260000427	01011	000000000	0000100010111	J8511
	7305	NSUL 24, REVERSAL ANGLE > 14.49 DEG	S	260000430	01011	000000000	0000100011000	J8511
	7306	NSUL 25, REVERSAL ANGLE > 15.88 DEG	S	260000431	01011	000000000	0000100011001	J8511
	7307	NSUL 26, REVERSAL ANGLE > 17.28 DEG	S	260000432	01011	000000000	0000100011010	J8511
	7308	NSUL 27, REVERSAL ANGLE > 18.67 DEG	S	260000433	01011	000000000	0000100011011	J8511
	7309	NSUL 28, REVERSAL ANGLE > 20.07 DEG	S	260000434	01011	000000000	0000100011100	J8511
	7310	NSUL 29, REVERSAL ANGLE > 21.47 DEG	S	260000435	01011	000000000	0000100011101	J8511
	7311	NSUL 30, REVERSAL ANGLE > 22.86 DEG	S	260000436	01011	000000000	0000100011110	J8511
	7312	NSUL 31, REVERSAL ANGLE > 24.26 DEG	S	260000437	01011	000000000	0000100011111	J8511
	7313	NSUL 32, REVERSAL ANGLE > 25.65 DEG	S	260000440	01011	000000000	0000100100000	J8511
	7314	NSUL 33, REVERSAL ANGLE > 27.05 DEG	S	260000441	01011	000000000	0000100100001	J8511
	7315	NSUL 34, REVERSAL ANGLE > 28.44 DEG	S	260000442	01011	000000000	0000100100010	J8511
	7316	NSUL 35, REVERSAL ANGLE > 29.84 DEG	S	260000443	01011	000000000	0000100100011	J8511
	7317	NSUL 36, REVERSAL ANGLE > 31.23 DEG	S	260000444	01011	000000000	0000100100100	J8511
	7318	NSUL 37, REVERSAL ANGLE > 32.63 DEG	S	260000445	01011	000000000	0000100100101	J8511
	7319	NSUL 38, REVERSAL ANGLE > 34.02 DEG	S	260000446	01011	000000000	0000100100110	J8511
	7320	NSUL 39, REVERSAL ANGLE > 35.42 DEG	S	260000447	01011	000000000	0000100100111	J8511
	7321	NSUL 40, REVERSAL ANGLE > 36.81 DEG	S	260000450	01011	000000000	0000100101000	J8511
	7322	NSUL 41, REVERSAL ANGLE > 38.21 DEG	S	260000451	01011	000000000	0000100101001	J8511
	7323	NSUL 42, REVERSAL ANGLE > 39.60 DEG	S	260000452	01011	000000000	0000100101010	J8511
	7324	NSUL 43, REVERSAL ANGLE > 41.00 DEG	S	260000453	01011	000000000	0000100101011	J8511
	7325	NSUL 44, REVERSAL ANGLE > 42.40 DEG	S	260000454	01011	000000000	0000100101100	J8511
	7326	NSUL 45, REVERSAL ANGLE > 43.79 DEG	S	260000455	01011	000000000	0000100101101	J8511
	7327	NSUL 46, REVERSAL ANGLE > 45.19 DEG	S	260000456	01011	000000000	0000100101110	J8511
	7328	NSUL 47, REVERSAL ANGLE > 46.58 DEG	S	260000457	01011	000000000	0000100101111	J8511

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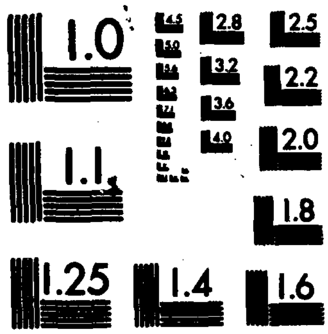

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7329	NSUL 48, REVERSAL ANGLE > 47.98 DEG	S	260000460	01011	000000000	0000100110000	J8511
7330	NSUL 49, REVERSAL ANGLE > 49.37 DEG	S	260000461	01011	000000000	0000100110001	J8511
7331	NSUL 50, REVERSAL ANGLE > 50.77 DEG	S	260000462	01011	000000000	0000100110010	J8511
7332	NSUL 51, REVERSAL ANGLE > 52.16 DEG	S	260000463	01011	000000000	0000100110011	J8511
7333	NSUL 52, REVERSAL ANGLE > 53.56 DEG	S	260000464	01011	000000000	0000100110100	J8511
7334	NSUL 53, REVERSAL ANGLE > 54.95 DEG	S	260000465	01011	000000000	0000100110101	J8511
7335	NSUL 54, REVERSAL ANGLE > 56.35 DEG	S	260000466	01011	000000000	0000100110110	J8511
7336	NSUL 55, REVERSAL ANGLE > 57.74 DEG	S	260000467	01011	000000000	0000100110111	J8511
7337	NSUL 56, REVERSAL ANGLE > 59.14 DEG	S	260000470	01011	000000000	0000100111000	J8511
7338	NSUL 57, REVERSAL ANGLE > 60.53 DEG	S	260000471	01011	000000000	0000100111001	J8511
7339	NSUL 58, REVERSAL ANGLE > 61.93 DEG	S	260000472	01011	000000000	0000100111010	J8511
7340	NSUL 59, REVERSAL ANGLE > 63.33 DEG	S	260000473	01011	000000000	0000100111011	J8511
7341	NSUL 60, REVERSAL ANGLE > 64.72 DEG	S	260000474	01011	000000000	0000100111100	J8511
7342	NSUL 61, REVERSAL ANGLE > 66.12 DEG	S	260000475	01011	000000000	0000100111101	J8511
7343	NSUL 62, REVERSAL ANGLE > 67.51 DEG	S	260000476	01011	000000000	0000100111110	J8511
7344	NSUL 63, REVERSAL ANGLE > 68.91 DEG	S	260000477	01011	000000000	0000100111111	J8511
7345	NSUL 64, REVERSAL ANGLE > 70.30 DEG	S	260000500	01011	000000000	0000101000000	J8511
7346	NSUL 65, REVERSAL ANGLE > 71.70 DEG	S	260000501	01011	000000000	0000101000001	J8511
7347	NSUL 66, REVERSAL ANGLE > 73.09 DEG	S	260000502	01011	000000000	0000101000010	J8511
7348	NSUL 67, REVERSAL ANGLE > 74.49 DEG	S	260000503	01011	000000000	0000101000011	J8511
7349	NSUL 68, REVERSAL ANGLE > 75.88 DEG	S	260000504	01011	000000000	0000101000100	J8511
7350	NSUL 69, REVERSAL ANGLE > 77.28 DEG	S	260000505	01011	000000000	0000101000101	J8511
7351	NSUL 70, REVERSAL ANGLE > 78.67 DEG	S	260000506	01011	000000000	0000101000110	J8511
7352	NSUL 71, REVERSAL ANGLE > 80.07 DEG	S	260000507	01011	000000000	0000101000111	J8511
7353	NSUL 72, REVERSAL ANGLE > 81.47 DEG	S	260000510	01011	000000000	0000101001000	J8511
7354	NSUL 73, REVERSAL ANGLE > 82.86 DEG	S	260000511	01011	000000000	0000101001001	J8511
7355	NSUL 74, REVERSAL ANGLE > 84.26 DEG	S	260000512	01011	000000000	0000101001010	J8511
7356	NSUL 75, REVERSAL ANGLE > 85.65 DEG	S	260000513	01011	000000000	0000101001011	J8511
7357	NSUL 76, REVERSAL ANGLE > 87.05 DEG	S	260000514	01011	000000000	0000101001100	J8511
7358	NSUL 77, REVERSAL ANGLE > 88.44 DEG	S	260000515	01011	000000000	0000101001101	J8511
7359	NSUL 78, REVERSAL ANGLE > 89.84 DEG	S	260000516	01011	000000000	0000101001110	J8511
7360	NSUL 79, REVERSAL ANGLE > 91.23 DEG	S	260000517	01011	000000000	0000101001111	J8511
7361	NSUL 80, REVERSAL ANGLE > 92.63 DEG	S	260000520	01011	000000000	0000101010000	J8511
7362	NSUL 81, REVERSAL ANGLE > 94.02 DEG	S	260000521	01011	000000000	0000101010001	J8511
7363	NSUL 82, REVERSAL ANGLE > 95.42 DEG	S	260000522	01011	000000000	0000101010010	J8511
7364	NSUL 83, REVERSAL ANGLE > 96.81 DEG	S	260000523	01011	000000000	0000101010011	J8511
7365	NSUL 84, REVERSAL ANGLE > 98.21 DEG	S	260000524	01011	000000000	0000101010100	J8511
7366	NSUL 85, REVERSAL ANGLE > 99.60 DEG	S	260000525	01011	000000000	0000101010101	J8511
7367	NSUL 86, REVERSAL ANGLE > 101.00 DEG	S	260000526	01011	000000000	0000101010110	J8511
7368	NSUL 87, REVERSAL ANGLE > 102.40 DEG	S	260000527	01011	000000000	0000101010111	J8511
7369	NSUL 88, REVEPSAL ANGLE > 103.79 DEG	S	260000530	01011	000000000	0000101011000	J8511
7370	NSUL 89, REVERSAL ANGLE > 105.19 DEG	S	260000531	01011	000000000	0000101011001	J8511
7371	NSUL 90, REVERSAL ANGLE > 106.58 DEG	S	260000532	01011	000000000	0000101011010	J8511
7372	NSUL 91, REVERSAL ANGLE > 107.98 DEG	S	260000533	01011	000000000	0000101011011	J8511
7373	NSUL 92, REVERSAL ANGLE > 109.37 DEG	S	260000534	01011	000000000	0000101011100	J8511
7374	NSUL 93, REVERSAL ANGLE > 110.77 DEG	S	260000535	01011	000000000	0000101011101	J8511
7375	NSUL 94, REVERSAL ANGLE > 112.16 DEG	S	260000536	01011	000000000	0000101011110	J8511
7376	NSUL 95, REVERSAL ANGLE > 113.56 DEG	S	260000537	01011	000000000	0000101011111	J8511
7377	NSUL 96, REVERSAL ANGLE > 114.95 DEG	S	260000540	01011	000000000	0000101100000	J8511
7378	NSUL 97, REVERSAL ANGLE > 116.35 DEG	S	260000541	01011	000000000	0000101100001	J8511

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P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7379	NSUL 98, REVERSAL ANGLE > 117.74 DEG	S	260000542	01011	000000000	0000101100010	J8511
	7380	NSUL 99, REVERSAL ANGLE > 119.14 DEG	S	260000543	01011	000000000	0000101100011	J8511
	7381	NSUL 100, REVERSAL ANGLE > 120.53 DEG	S	260000544	01011	000000000	0000101100100	J8511
	7382	NSUL 101, REVERSAL ANGLE > 121.93 DEG	S	260000545	01011	000000000	0000101100101	J8511
	7383	NSUL 102, REVERSAL ANGLE > 123.33 DEG	S	260000546	01011	000000000	0000101100110	J8511
	7384	NSUL 103, REVERSAL ANGLE > 124.72 DEG	S	260000547	01011	000000000	0000101100111	J8511
	7385	NSUL 104, REVERSAL ANGLE > 126.12 DEG	S	260000550	01011	000000000	0000101101000	J8511
	7386	NSUL 105, REVERSAL ANGLE > 127.51 DEG	S	260000551	01011	000000000	0000101101001	J8511
	7387	NSUL 106, REVERSAL ANGLE > 128.91 DEG	S	260000552	01011	000000000	0000101101010	J8511
	7388	NSUL 107, REVERSAL ANGLE > 130.30 DEG	S	260000553	01011	000000000	0000101101011	J8511
	7389	NSUL 108, REVERSAL ANGLE > 131.70 DEG	S	260000554	01011	000000000	0000101101100	J8511
	7390	NSUL 109, REVERSAL ANGLE > 133.09 DEG	S	260000555	01011	000000000	0000101101101	J8511
	7391	NSUL 110, REVERSAL ANGLE > 134.49 DEG	S	260000556	01011	000000000	0000101101110	J8511
	7392	NSUL 111, REVERSAL ANGLE > 135.88 DEG	S	260000557	01011	000000000	0000101101111	J8511
	7393	NSUL 112, REVERSAL ANGLE > 137.28 DEG	S	260000560	01011	000000000	0000101110000	J8511
	7394	NSUL 113, REVERSAL ANGLE > 138.67 DEG	S	260000561	01011	000000000	0000101110001	J8511
	7395	NSUL 114, REVERSAL ANGLE > 140.07 DEG	S	260000562	01011	000000000	0000101110010	J8511
	7396	NSUL 115, REVERSAL ANGLE > 141.47 DEG	S	260000563	01011	000000000	0000101110011	J8511
	7397	NSUL 116, REVERSAL ANGLE > 142.86 DEG	S	260000564	01011	000000000	0000101110100	J8511
	7399	NSUL 117, REVERSAL ANGLE > 144.26 DEG	S	260000565	01011	000000000	0000101110101	J8511
	7399	NSUL 118, REVERSAL ANGLE > 145.65 DEG	S	260000566	01011	000000000	0000101110110	J8511
	7400	NSUL 119, REVERSAL ANGLE > 147.05 DEG	S	260000567	01011	000000000	0000101110111	J8511
	7401	NSUL 120, REVERSAL ANGLE > 148.44 DEG	S	260000570	01011	000000000	0000101111000	J8511
	7402	NSUL 121, REVERSAL ANGLE > 149.84 DEG	S	260000571	01011	000000000	0000101111001	J8511
	7403	NSUL 122, REVERSAL ANGLE > 151.23 DEG	S	260000572	01011	000000000	0000101111010	J8511
	7404	NSUL 123, REVERSAL ANGLE > 152.63 DEG	S	260000573	01011	000000000	0000101111011	J8511
	7405	NSUL 124, REVERSAL ANGLE > 154.02 DEG	S	260000574	01011	000000000	0000101111100	J8511
	7406	NSUL 125, REVERSAL ANGLE > 155.42 DEG	S	260000575	01011	000000000	0000101111101	J8511
	7407	NSUL 126, REVERSAL ANGLE > 156.81 DEG	S	260000576	01011	000000000	0000101111110	J8511
	7408	NSUL 127, REVERSAL ANGLE > 158.21 DEG	S	260000577	01011	000000000	0000101111111	J8511
	7409	NSUL 128, REVERSAL ANGLE > 159.60 DEG	S	260000600	01011	000000000	0000110000000	J8511
	7410	NSUL 129, REVERSAL ANGLE > 161.00 DEG	S	260000601	01011	000000000	0000110000001	J8511
	7411	NSUL 130, REVERSAL ANGLE > 162.40 DEG	S	260000602	01011	000000000	0000110000010	J8511
	7412	NSUL 131, REVERSAL ANGLE > 163.79 DEG	S	260000603	01011	000000000	0000110000011	J8511
	7413	NSUL 132, REVERSAL ANGLE > 165.19 DEG	S	260000604	01011	000000000	0000110000100	J8511
	7414	NSUL 133, REVERSAL ANGLE > 166.58 DEG	S	260000605	01011	000000000	0000110000101	J8511
	7415	NSUL 134, REVERSAL ANGLE > 167.98 DEG	S	260000606	01011	000000000	0000110000110	J8511
	7416	NSUL 135, REVERSAL ANGLE > 169.37 DEG	S	260000607	01011	000000000	0000110000111	J8511
	7417	NSUL 136, REVERSAL ANGLE > 170.77 DEG	S	260000610	01011	000000000	0000110001000	J8511
	7418	NSUL 137, REVERSAL ANGLE > 172.16 DEG	S	260000611	01011	000000000	0000110001001	J8511
	7419	NSUL 138, REVERSAL ANGLE > 173.56 DEG	S	260000612	01011	000000000	0000110001010	J8511
	7420	NSUL 139, REVERSAL ANGLE > 174.95 DEG	S	260000613	01011	000000000	0000110001011	J8511
	7421	NSUL 140, REVERSAL ANGLE > 176.35 DEG	S	260000614	01011	000000000	0000110001100	J8511
	7422	NSUL 141, REVERSAL ANGLE > 177.74 DEG	S	260000615	01011	000000000	0000110001101	J8511
	7423	NSUL 142, REVERSAL ANGLE > 179.14 DEG	S	260000616	01011	000000000	0000110001110	J8511
	7424	NSUL 143, REVERSAL ANGLE > 180.53 DEG	S	260000617	01011	000000000	0000110001111	J8511
	7425	NSUL 144, REVERSAL ANGLE > 181.93 DEG	S	260000620	01011	000000000	0000110010000	J8511
	7426	NSUL 145, REVERSAL ANGLE > 183.33 DEG	S	260000621	01011	000000000	0000110010001	J8511
	7427	NSUL 146, REVERSAL ANGLE > 184.72 DEG	S	260000622	01011	000000000	0000110010010	J8511
	7428	NSUL 147, REVERSAL ANGLE > 186.12 DEG	S	260000623	01011	000000000	0000110010011	J8511

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7429	NSUL 148, REVERSAL ANGLE > 187.51 DEG	S	260000624	01011	000000000	0000110010100	J8511
7430	NSUL 149, REVERSAL ANGLE > 188.91 DEG	S	260000625	01011	000000000	0000110010101	J8511
7431	NSUL 150, REVERSAL ANGLE > 190.30 DEG	S	260000626	01011	000000000	0000110010110	J8511
7432	NSUL 151, REVERSAL ANGLE > 191.70 DEG	S	260000627	01011	000000000	0000110010111	J8511
7433	NSUL 152, REVERSAL ANGLE > 193.09 DEG	S	260000630	01011	000000000	0000110011000	J8511
7434	NSUL 153, REVERSAL ANGLE > 194.49 DEG	S	260000631	01011	000000000	0000110011001	J8511
7435	NSUL 154, REVERSAL ANGLE > 195.88 DEG	S	260000632	01011	000000000	0000110011010	J8511
7436	NSUL 155, REVERSAL ANGLE > 197.28 DEG	S	260000633	01011	000000000	0000110011011	J8511
7437	NSUL 156, REVERSAL ANGLE > 198.67 DEG	S	260000634	01011	000000000	0000110011100	J8511
7438	NSUL 157, REVERSAL ANGLE > 200.07 DEG	S	260000635	01011	000000000	0000110011101	J8511
7439	NSUL 158, REVERSAL ANGLE > 201.47 DEG	S	260000636	01011	000000000	0000110011110	J8511
7440	NSUL 159, REVERSAL ANGLE > 202.86 DEG	S	260000637	01011	000000000	0000110011111	J8511
7441	NSUL 160, REVERSAL ANGLE > 204.26 DEG	S	260000640	01011	000000000	0000110100000	J8511
7442	NSUL 161, REVERSAL ANGLE > 205.65 DEG	S	260000641	01011	000000000	0000110100001	J8511
7443	NSUL 162, REVERSAL ANGLE > 207.05 DEG	S	260000642	01011	000000000	0000110100010	J8511
7444	NSUL 163, REVERSAL ANGLE > 208.44 DEG	S	260000643	01011	000000000	0000110100011	J8511
7445	NSUL 164, REVERSAL ANGLE > 209.84 DEG	S	260000644	01011	000000000	0000110100100	J8511
7446	NSUL 165, REVERSAL ANGLE > 211.23 DEG	S	260000645	01011	000000000	0000110100101	J8511
7447	NSUL 166, REVERSAL ANGLE > 212.63 DEG	S	260000646	01011	000000000	0000110100110	J8511
7448	NSUL 167, REVERSAL ANGLE > 214.02 DEG	S	260000647	01011	000000000	0000110100111	J8511
7449	NSUL 168, REVERSAL ANGLE > 215.42 DEG	S	260000650	01011	000000000	0000110101000	J8511
7450	NSUL 169, REVERSAL ANGLE > 216.81 DEG	S	260000651	01011	000000000	0000110101001	J8511
7451	NSUL 170, REVERSAL ANGLE > 218.21 DEG	S	260000652	01011	000000000	0000110101010	J8511
7452	NSUL 171, REVERSAL ANGLE > 219.60 DEG	S	260000653	01011	000000000	0000110101011	J8511
7453	NSUL 172, REVERSAL ANGLE > 221.00 DEG	S	260000554	01011	000000000	0000110101100	J8511
7454	NSUL 173, REVERSAL ANGLE > 222.40 DEG	S	260000655	01011	000000000	0000110101101	J8511
7455	NSUL 174, REVERSAL ANGLE > 223.79 DEG	S	260000656	01011	000000000	0000110101110	J8511
7456	NSUL 175, REVERSAL ANGLE > 225.19 DEG	S	260000657	01011	000000000	0000110101111	J8511
7457	NSUL 176, REVERSAL ANGLE > 226.58 DEG	S	260000660	01011	000000000	0000110110000	J8511
7458	NSUL 177, REVERSAL ANGLE > 227.98 DEG	S	260000661	01011	000000000	0000110110001	J8511
7459	NSUL 178, REVERSAL ANGLE > 229.37 DEG	S	260000662	01011	000000000	0000110110010	J8511
7460	NSUL 179, REVERSAL ANGLE > 230.77 DEG	S	260000663	01011	000000000	0000110110011	J8511
7461	NSUL 180, REVERSAL ANGLE > 232.16 DEG	S	260000664	01011	000000000	0000110110100	J8511
7462	NSUL 0, FORCED REVERSAL ANGLE	S	260000400	01011	000000000	0000100000000	J8511
7463	NSUL 255, FORCED REVERSAL ANGLE	S	260000777	01011	000000000	0000111111111	J8511
7464	EWLL 1, REVERSAL ANGLE < -17.60 DEG	S	260001001	01011	000000000	0001000000001	J8512
7465	EWLL 2, REVERSAL ANGLE < -16.21 DEG	S	260001002	01011	000000000	0001000000010	J8512
7466	EWLL 3, REVERSAL ANGLE < -14.81 DEG	S	260001003	01011	000000000	0001000000011	J8512
7467	EWLL 4, REVERSAL ANGLE < -13.42 DEG	S	260001004	01011	000000000	0001000000100	J8512
7468	EWLL 5, REVERSAL ANGLE < -12.02 DEG	S	260001005	01011	000000000	0001000000101	J8512
7469	EWLL 6, REVERSAL ANGLE < -10.63 DEG	S	260001006	01011	000000000	0001000000110	J8512
7470	EWLL 7, REVERSAL ANGLE < -9.23 DEG	S	260001007	01011	000000000	0001000000111	J8512
7471	EWLL 8, REVERSAL ANGLE < -7.84 DEG	S	260001010	01011	000000000	0001000001000	J8512
7472	EWLL 9, REVERSAL ANGLE < -6.44 DEG	S	260001011	01011	000000000	0001000001001	J8512
7473	EWLL 10, REVERSAL ANGLE < -5.05 DEG	S	260001012	01011	000000000	0001000001010	J8512
7474	EWLL 11, REVERSAL ANGLE < -3.65 DEG	S	260001013	01011	000000000	0001000001011	J8512
7475	EWLL 12, REVERSAL ANGLE < -2.26 DEG	S	260001014	01011	000000000	0001000001100	J8512
7476	EWLL 13, REVERSAL ANGLE < -0.86 DEG	S	260001015	01011	000000000	0001000001101	J8512
7477	EWLL 14, REVERSAL ANGLE < 0.53 DEG	S	260001016	01011	000000000	0001000001110	J8512
7478	EWLL 15, REVERSAL ANGLE < 1.93 DEG	S	260001017	01011	000000000	0001000001111	J8512

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P7S-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7479	EWLL 16, REVERSAL ANGLE < 3.33 DEG	S	260001020	01011	000000000	0001000010000	J8512
	7480	EWLL 17, REVERSAL ANGLE < 4.72 DEG	S	260001021	01011	000000000	0001000010001	J8512
	7481	EWLL 18, REVERSAL ANGLE < 6.12 DEG	S	260001022	01011	000000000	0001000010010	J8512
	7482	EWLL 19, REVERSAL ANGLE < 7.51 DEG	S	260001023	01011	000000000	0001000010011	J8512
	7483	EWLL 20, REVERSAL ANGLE < 8.91 DEG	S	260001024	01011	000000000	0001000010100	J8512
	7484	EWLL 21, REVERSAL ANGLE < 10.30 DEG	S	260001025	01011	000000000	0001000010101	J8512
	7485	EWLL 22, REVERSAL ANGLE < 11.70 DEG	S	260001026	01011	000000000	0001000010110	J8512
	7486	EWLL 23, REVERSAL ANGLE < 13.09 DEG	S	260001027	01011	000000000	0001000010111	J8512
	7487	EWLL 24, REVERSAL ANGLE < 14.49 DEG	S	260001030	01011	000000000	0001000011000	J8512
	7488	EWLL 25, REVERSAL ANGLE < 15.88 DEG	S	260001031	01011	000000000	0001000011001	J8512
	7489	EWLL 26, REVERSAL ANGLE < 17.28 DEG	S	260001032	01011	000000000	0001000011010	J8512
	7490	EWLL 27, REVERSAL ANGLE < 18.67 DEG	S	260001033	01011	000000000	0001000011011	J8512
	7491	EWLL 28, REVERSAL ANGLE < 20.07 DEG	S	260001034	01011	000000000	0001000011100	J8512
	7492	EWLL 29, REVERSAL ANGLE < 21.47 DEG	S	260001035	01011	000000000	0001000011101	J8512
	7493	EWLL 30, REVERSAL ANGLE < 22.86 DEG	S	260001036	01011	000000000	0001000011110	J8512
	7494	EWLL 31, REVERSAL ANGLE < 24.26 DEG	S	260001037	01011	000000000	0001000011111	J8512
	7495	EWLL 32, REVERSAL ANGLE < 25.65 DEG	S	260001040	01011	000000000	0001000100000	J8512
	7496	EWLL 33, REVERSAL ANGLE < 27.05 DEG	S	260001041	01011	000000000	0001000100001	J8512
	7497	EWLL 34, REVERSAL ANGLE < 28.44 DEG	S	260001042	01011	000000000	0001000100010	J8512
	7498	EWLL 35, REVERSAL ANGLE < 29.84 DEG	S	260001043	01011	000000000	0001000100011	J8512
	7499	EWLL 36, REVERSAL ANGLE < 31.23 DEG	S	260001044	01011	000000000	0001000100100	J8512
	7500	EWLL 37, REVERSAL ANGLE < 32.63 DEG	S	260001045	01011	000000000	0001000100101	J8512
	7501	EWLL 38, REVERSAL ANGLE < 34.02 DEG	S	260001046	01011	000000000	0001000100110	J8512
	7502	EWLL 39, REVERSAL ANGLE < 35.42 DEG	S	260001047	01011	000000000	0001000100111	J8512
	7503	EWLL 40, REVERSAL ANGLE < 36.81 DEG	S	260001050	01011	000000000	0001000101000	J8512
	7504	EWLL 41, REVERSAL ANGLE < 38.21 DEG	S	260001051	01011	000000000	0001000101001	J8512
	7505	EWLL 42, REVERSAL ANGLE < 39.60 DEG	S	260001052	01011	000000000	0001000101010	J8512
	7506	EWLL 43, REVERSAL ANGLE < 41.00 DEG	S	260001053	01011	000000000	0001000101011	J8512
	7507	EWLL 44, REVERSAL ANGLE < 42.40 DEG	S	260001054	01011	000000000	0001000101100	J8512
	7508	EWLL 45, REVERSAL ANGLE < 43.79 DEG	S	260001055	01011	000000000	0001000101101	J8512
	7509	EWLL 46, REVERSAL ANGLE < 45.19 DEG	S	260001056	01011	000000000	0001000101110	J8512
	7510	EWLL 47, REVERSAL ANGLE < 46.58 DEG	S	260001057	01011	000000000	0001000101111	J8512
	7511	EWLL 48, REVERSAL ANGLE < 47.98 DEG	S	260001060	01011	000000000	0001000110000	J8512
	7512	EWLL 49, REVERSAL ANGLE < 49.37 DEG	S	260001061	01011	000000000	0001000110001	J8512
	7513	EWLL 50, REVERSAL ANGLE < 50.77 DEG	S	260001062	01011	000000000	0001000110010	J8512
	7514	EWLL 51, REVERSAL ANGLE < 52.16 DEG	S	260001063	01011	000000000	0001000110011	J8512
	7515	EWLL 52, REVERSAL ANGLE < 53.56 DEG	S	260001064	01011	000000000	0001000110100	J8512
	7516	EWLL 53, REVERSAL ANGLE < 54.95 DEG	S	260001065	01011	000000000	0001000110101	J8512
	7517	EWLL 54, REVERSAL ANGLE < 56.35 DEG	S	260001066	01011	000000000	0001000110110	J8512
	7518	EWLL 55, REVERSAL ANGLE < 57.74 DEG	S	260001067	01011	000000000	0001000110111	J8512
	7519	EWLL 56, REVERSAL ANGLE < 59.14 DEG	S	260001070	01011	000000000	0001000111000	J8512
	7520	EWLL 57, REVERSAL ANGLE < 60.53 DEG	S	260001071	01011	000000000	0001000111001	J8512
	7521	EWLL 58, REVERSAL ANGLE < 61.93 DEG	S	260001072	01011	000000000	0001000111010	J8512
	7522	EWLL 59, REVERSAL ANGLE < 63.33 DEG	S	260001073	01011	000000000	0001000111011	J8512
	7523	EWLL 60, REVERSAL ANGLE < 64.72 DEG	S	260001074	01011	000000000	0001000111100	J8512
	7524	EWLL 61, REVERSAL ANGLE < 66.12 DEG	S	260001075	01011	000000000	0001000111101	J8512
	7525	EWLL 62, REVERSAL ANGLE < 67.51 DEG	S	260001076	01011	000000000	0001000111110	J8512
	7526	EWLL 63, REVERSAL ANGLE < 68.91 DEG	S	260001077	01011	000000000	0001000111111	J8512
	7527	EWLL 64, REVERSAL ANGLE < 70.30 DEG	S	260001100	01011	000000000	0001001000000	J8512
	7528	EWLL 65, REVERSAL ANGLE < 71.70 DEG	S	260001101	01011	000000000	0001001000001	J8512

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
7529	EWLL 66, REVERSAL ANGLE < 73.09 DEG	S	260001102	01011 000000000 0001001000010	J8512
7530	EWLL 67, REVERSAL ANGLE < 74.49 DEG	S	260001103	01011 000000000 0001001000011	J8512
7531	EWLL 68, REVERSAL ANGLE < 75.88 DEG	S	260001104	01011 000000000 0001001000100	J8512
7532	EWLL 69, REVERSAL ANGLE < 77.28 DEG	S	260001105	01011 000000000 0001001000101	J8512
7533	EWLL 70, REVERSAL ANGLE < 78.67 DEG	S	260001106	01011 000000000 0001001000110	J8512
7534	EWLL 71, REVERSAL ANGLE < 80.07 DEG	S	260001107	01011 000000000 0001001000111	J8512
7535	EWLL 72, REVERSAL ANGLE < 81.47 DEG	S	260001110	01011 000000000 0001001001000	J8512
7536	EWLL 73, REVERSAL ANGLE < 82.86 DEG	S	260001111	01011 000000000 0001001001001	J8512
7537	EWLL 74, REVERSAL ANGLE < 84.26 DEG	S	260001112	01011 000000000 0001001001010	J8512
7538	EWLL 75, REVERSAL ANGLE < 85.65 DEG	S	260001113	01011 000000000 0001001001011	J8512
7539	EWLL 76, REVERSAL ANGLE < 87.05 DEG	S	260001114	01011 000000000 0001001001100	J8512
7540	EWLL 77, REVERSAL ANGLE < 88.44 DEG	S	260001115	01011 000000000 0001001001101	J8512
7541	EWLL 78, REVERSAL ANGLE < 89.84 DEG	S	260001116	01011 000000000 0001001001110	J8512
7542	EWLL 79, REVERSAL ANGLE < 91.23 DEG	S	260001117	01011 000000000 0001001001111	J8512
7543	EWLL 80, REVERSAL ANGLE < 92.63 DEG	S	260001120	01011 000000000 0001001010000	J8512
7544	EWLL 81, REVERSAL ANGLE < 94.02 DEG	S	260001121	01011 000000000 0001001010001	J8512
7545	EWLL 82, REVERSAL ANGLE < 95.42 DEG	S	260001122	01011 000000000 0001001010010	J8512
7546	EWLL 83, REVERSAL ANGLE < 96.81 DEG	S	260001123	01011 000000000 0001001010011	J8512
7547	EWLL 84, REVERSAL ANGLE < 98.21 DEG	S	260001124	01011 000000000 0001001010100	J8512
7548	EWLL 85, REVERSAL ANGLE < 99.60 DEG	S	260001125	01011 000000000 0001001010101	J8512
7549	EWLL 86, REVERSAL ANGLE < 101.00 DEG	S	260001126	01011 000000000 0001001010110	J8512
7550	EWLL 87, REVERSAL ANGLE < 102.40 DEG	S	260001127	01011 000000000 0001001010111	J8512
7551	EWLL 88, REVERSAL ANGLE < 103.79 DEG	S	260001130	01011 000000000 0001001011000	J8512
7552	EWLL 89, REVERSAL ANGLE < 105.19 DEG	S	260001131	01011 000000000 0001001011001	J8512
7553	EWLL 90, REVERSAL ANGLE < 106.58 DEG	S	260001132	01011 000000000 0001001011010	J8512
7554	EWLL 91, REVERSAL ANGLE < 107.98 DEG	S	260001133	01011 000000000 0001001011011	J8512
7555	EWLL 92, REVERSAL ANGLE < 109.37 DEG	S	260001134	01011 000000000 0001001011100	J8512
7556	EWLL 93, REVERSAL ANGLE < 110.77 DEG	S	260001135	01011 000000000 0001001011101	J8512
7557	EWLL 94, REVERSAL ANGLE < 112.16 DEG	S	260001136	01011 000000000 0001001011110	J8512
7558	EWLL 95, REVERSAL ANGLE < 113.56 DEG	S	260001137	01011 000000000 0001001011111	J8512
7559	EWLL 96, REVERSAL ANGLE < 114.95 DEG	S	260001140	01011 000000000 0001001100000	J8512
7560	EWLL 97, REVERSAL ANGLE < 116.35 DEG	S	260001141	01011 000000000 0001001100001	J8512
7561	EWLL 98, REVERSAL ANGLE < 117.74 DEG	S	260001142	01011 000000000 0001001100010	J8512
7562	EWLL 99, REVERSAL ANGLE < 119.14 DEG	S	260001143	01011 000000000 0001001100011	J8512
7563	EWLL 100, REVERSAL ANGLE < 120.53 DEG	S	260001144	01011 000000000 0001001100100	J8512
7564	EWLL 101, REVERSAL ANGLE < 121.93 DEG	S	260001145	01011 000000000 0001001100101	J8512
7565	EWLL 102, REVERSAL ANGLE < 123.33 DEG	S	260001146	01011 000000000 0001001100110	J8512
7566	EWLL 103, REVERSAL ANGLE < 124.72 DEG	S	260001147	01011 000000000 0001001100111	J8512
7567	EWLL 104, REVERSAL ANGLE < 126.12 DEG	S	260001150	01011 000000000 0001001101000	J8512
7568	EWLL 105, REVERSAL ANGLE < 127.51 DEG	S	260001151	01011 000000000 0001001101001	J8512
7569	EWLL 106, REVERSAL ANGLE < 128.91 DEG	S	260001152	01011 000000000 0001001101010	J8512
7570	EWLL 107, REVERSAL ANGLE < 130.30 DEG	S	260001153	01011 000000000 0001001101011	J8512
7571	EWLL 108, REVERSAL ANGLE < 131.70 DEG	S	260001154	01011 000000000 0001001101100	J8512
7572	EWLL 109, REVERSAL ANGLE < 133.09 DEG	S	260001155	01011 000000000 0001001101101	J8512
7573	EWLL 110, REVERSAL ANGLE < 134.49 DEG	S	260001156	01011 000000000 0001001101110	J8512
7574	EWLL 111, REVERSAL ANGLE < 135.88 DEG	S	260001157	01011 000000000 0001001101111	J8512
7575	EWLL 112, REVERSAL ANGLE < 137.28 DEG	S	260001160	01011 000000000 0001001110000	J8512
7576	EWLL 113, REVERSAL ANGLE < 138.67 DEG	S	260001161	01011 000000000 0001001110001	J8512
7577	EWLL 114, REVERSAL ANGLE < 140.07 DEG	S	260001162	01011 000000000 0001001110010	J8512
7578	EWLL 115, REVERSAL ANGLE < 141.47 DEG	S	260001163	01011 000000000 0001001110011	J8512

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(*))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7579	EWLL 116, REVERSAL ANGLE < 142.86 DEG	S	260001164	01011	000000000	0001001110100	J8512
7580	EWLL 117, REVERSAL ANGLE < 144.26 DEG	S	260001165	01011	000000000	0001001110101	J8512
7581	EWLL 118, REVERSAL ANGLE < 145.65 DEG	S	260001166	01011	000000000	0001001110110	J8512
7582	EWLL 119, REVERSAL ANGLE < 147.05 DEG	S	260001167	01011	000000000	0001001110111	J8512
7583	EWLL 120, REVERSAL ANGLE < 148.44 DEG	S	260001170	01011	000000000	0001001111000	J8512
7584	EWLL 121, REVERSAL ANGLE < 149.84 DEG	S	260001171	01011	000000000	0001001111001	J8512
7585	EWLL 122, REVERSAL ANGLE < 151.23 DEG	S	260001172	01011	000000000	0001001111010	J8512
7586	EWLL 123, REVERSAL ANGLE < 152.63 DEG	S	260001173	01011	000000000	0001001111011	J8512
7587	EWLL 124, REVERSAL ANGLE < 154.02 DEG	S	260001174	01011	000000000	0001001111100	J8512
7588	EWLL 125, REVERSAL ANGLE < 155.42 DEG	S	260001175	01011	000000000	0001001111101	J8512
7589	EWLL 126, REVERSAL ANGLE < 156.81 DEG	S	260001176	01011	000000000	0001001111110	J8512
7590	EWLL 127, REVERSAL ANGLE < 158.21 DEG	S	260001177	01011	000000000	0001001111111	J8512
7591	EWLL 128, REVERSAL ANGLE < 159.60 DEG	S	260001200	01011	000000000	0001010000000	J8512
7592	EWLL 129, REVERSAL ANGLE < 161.00 DEG	S	260001201	01011	000000000	0001010000001	J8512
7593	EWLL 130, REVERSAL ANGLE < 162.40 DEG	S	260001202	01011	000000000	0001010000010	J8512
7594	EWLL 131, REVERSAL ANGLE < 163.79 DEG	S	260001203	01011	000000000	0001010000011	J8512
7595	EWLL 132, REVERSAL ANGLE < 165.19 DEG	S	260001204	01011	000000000	0001010000100	J8512
7596	EWLL 133, REVERSAL ANGLE < 166.58 DEG	S	260001205	01011	000000000	0001010000101	J8512
7597	EWLL 134, REVERSAL ANGLE < 167.98 DEG	S	260001206	01011	000000000	0001010000110	J8512
7598	EWLL 135, REVERSAL ANGLE < 169.37 DEG	S	260001207	01011	000000000	0001010000111	J8512
7599	EWLL 136, REVERSAL ANGLE < 170.77 DEG	S	260001210	01011	000000000	0001010001000	J8512
7600	EWLL 137, REVERSAL ANGLE < 172.16 DEG	S	260001211	01011	000000000	0001010001001	J8512
7601	EWLL 138, REVERSAL ANGLE < 173.56 DEG	S	260001212	01011	000000000	0001010001010	J8512
7602	EWLL 139, REVERSAL ANGLE < 174.95 DEG	S	260001213	01011	000000000	0001010001011	J8512
7603	EWLL 140, REVERSAL ANGLE < 176.35 DEG	S	260001214	01011	000000000	0001010001100	J8512
7604	EWLL 141, REVERSAL ANGLE < 177.74 DEG	S	260001215	01011	000000000	0001010001101	J8512
7605	EWLL 142, REVERSAL ANGLE < 179.14 DEG	S	260001216	01011	000000000	0001010001110	J8512
7606	EWLL 143, REVERSAL ANGLE < 180.53 DEG	S	260001217	01011	000000000	0001010001111	J8512
7607	EWLL 144, REVERSAL ANGLE < 181.93 DEG	S	260001220	01011	000000000	0001010010000	J8512
7608	EWLL 145, REVERSAL ANGLE < 183.33 DEG	S	260001221	01011	000000000	0001010010001	J8512
7609	EWLL 146, REVERSAL ANGLE < 184.72 DEG	S	260001222	01011	000000000	0001010010010	J8512
7610	EWLL 147, REVERSAL ANGLE < 186.12 DEG	S	260001223	01011	000000000	0001010010011	J8512
7611	EWLL 148, REVERSAL ANGLE < 187.51 DEG	S	260001224	01011	000000000	0001010010100	J8512
7612	EWLL 149, REVERSAL ANGLE < 188.91 DEG	S	260001225	01011	000000000	0001010010101	J8512
7613	EWLL 150, REVERSAL ANGLE < 190.30 DEG	S	260001226	01011	000000000	0001010010110	J8512
7614	EWLL 151, REVERSAL ANGLE < 191.70 DEG	S	260001227	01011	000000000	0001010010111	J8512
7615	EWLL 152, REVERSAL ANGLE < 193.09 DEG	S	260001230	01011	000000000	0001010011000	J8512
7616	EWLL 153, REVERSAL ANGLE < 194.49 DEG	S	260001231	01011	000000000	0001010011001	J8512
7617	EWLL 154, REVERSAL ANGLE < 195.88 DEG	S	260001232	01011	000000000	0001010011010	J8512
7618	EWLL 155, REVERSAL ANGLE < 197.28 DEG	S	260001233	01011	000000000	0001010011011	J8512
7619	EWLL 156, REVERSAL ANGLE < 198.67 DEG	S	260001234	01011	000000000	0001010011100	J8512
7620	EWLL 157, REVERSAL ANGLE < 200.07 DEG	S	260001235	01011	000000000	0001010011101	J8512
7621	EWLL 158, REVERSAL ANGLE < 201.47 DEG	S	260001236	01011	000000000	0001010011110	J8512
7622	EWLL 159, REVERSAL ANGLE < 202.86 DEG	S	260001237	01011	000000000	0001010011111	J8512
7623	EWLL 160, REVERSAL ANGLE < 204.26 DEG	S	260001240	01011	000000000	0001010100000	J8512
7624	EWLL 161, REVERSAL ANGLE < 205.65 DEG	S	260001241	01011	000000000	0001010100001	J8512
7625	EWLL 162, REVERSAL ANGLE < 207.05 DEG	S	260001242	01011	000000000	0001010100010	J8512
7626	EWLL 163, REVERSAL ANGLE < 208.44 DEG	S	260001243	01011	000000000	0001010100011	J8512
7627	EWLL 164, REVERSAL ANGLE < 209.84 DEG	S	260001244	01011	000000000	0001010100100	J8512
7628	EWLL 165, REVERSAL ANGLE < 211.23 DEG	S	260001245	01011	000000000	0001010100101	J8512

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P78-2 COMMAND LIST 08-18-78 REV ?   STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT   ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7629	EWLL 166, REVERSAL ANGLE < 212.63 DEG	S	260001246	01011	000000000	0001010100110	J8512
7630	EWLL 167, REVERSAL ANGLE < 214.02 DEG	S	260001247	01011	000000000	0001010100111	J8512
7631	EWLL 168, REVERSAL ANGLE < 215.42 DEG	S	260001250	01011	000000000	0001010101000	J8512
7632	EWLL 169, REVERSAL ANGLE < 216.81 DEG	S	260001251	01011	000000000	0001010101001	J8512
7633	EWLL 170, REVERSAL ANGLE < 218.21 DEG	S	260001252	01011	000000000	0001010101010	J8512
7634	EWLL 171, REVERSAL ANGLE < 219.60 DEG	S	260001253	01011	000000000	0001010101011	J8512
7635	EWLL 172, REVERSAL ANGLE < 221.00 DEG	S	260001254	01011	000000000	0001010101100	J8512
7636	EWLL 173, REVERSAL ANGLE < 222.40 DEG	S	260001255	01011	000000000	0001010101101	J8512
7637	EWLL 174, REVERSAL ANGLE < 223.79 DEG	S	260001256	01011	000000000	0001010101110	J8512
7638	EWLL 175, REVERSAL ANGLE < 225.19 DEG	S	260001257	01011	000000000	0001010101111	J8512
7639	EWLL 176, REVERSAL ANGLE < 226.58 DEG	S	260001260	01011	000000000	0001010110000	J8512
7640	EWLL 177, REVERSAL ANGLE < 227.98 DEG	S	260001261	01011	000000000	0001010110001	J8512
7641	EWLL 178, REVERSAL ANGLE < 229.37 DEG	S	260001262	01011	000000000	0001010110010	J8512
7642	EWLL 179, REVERSAL ANGLE < 230.77 DEG	S	260001263	01011	000000000	0001010110011	J8512
7643	EWLL 180, REVERSAL ANGLE < 232.16 DEG	S	260001264	01011	000000000	0001010110100	J8512
7644	EWLL 0, FORCED REVERSAL ANGLE	S	260001000	01011	000000000	0001000000000	J8512
7645	EWLL 255, FORCED REVERSAL ANGLE	S	260001377	01011	000000000	0001011111111	J8512
7646	EWUL 1, REVERSAL ANGLE > -17.60 DEG	S	260001401	01011	000000000	0001100000001	J8513
7647	EWUL 2, REVERSAL ANGLE > -16.21 DEG	S	260001402	01011	000000000	0001100000010	J8513
7648	EWUL 3, REVERSAL ANGLE > -14.81 DEG	S	260001403	01011	000000000	0001100000011	J8513
7649	EWUL 4, REVERSAL ANGLE > -13.42 DEG	S	260001404	01011	000000000	0001100000100	J8513
7650	EWUL 5, REVERSAL ANGLE > -12.02 DEG	S	260001405	01011	000000000	0001100000101	J8513
7651	EWUL 6, REVERSAL ANGLE > -10.63 DEG	S	260001406	01011	000000000	0001100000110	J8513
7652	EWUL 7, REVERSAL ANGLE > -9.23 DEG	S	260001407	01011	000000000	0001100000111	J8513
7653	EWUL 8, REVERSAL ANGLE > -7.84 DEG	S	260001410	01011	000000000	0001100001000	J8513
7654	EWUL 9, REVERSAL ANGLE > -6.44 DEG	S	260001411	01011	000000000	0001100001001	J8513
7655	EWUL 10, REVERSAL ANGLE > -5.05 DEG	S	260001412	01011	000000000	0001100001010	J8513
7656	EWUL 11, REVERSAL ANGLE > -3.65 DEG	S	260001413	01011	000000000	0001100001011	J8513
7657	EWUL 12, REVERSAL ANGLE > -2.26 DEG	S	260001414	01011	000000000	0001100001100	J8513
7658	EWUL 13, REVERSAL ANGLE > -0.86 DEG	S	260001415	01011	000000000	0001100001101	J8513
7659	EWUL 14, REVERSAL ANGLE > 0.53 DEG	S	260001416	01011	000000000	0001100001110	J8513
7660	EWUL 15, REVERSAL ANGLE > 1.93 DEG	S	260001417	01011	000000000	0001100001111	J8513
7661	EWUL 16, REVERSAL ANGLE > 3.33 DEG	S	260001420	01011	000000000	0001100010000	J8513
7662	EWUL 17, REVERSAL ANGLE > 4.72 DEG	S	260001421	01011	000000000	0001100010001	J8513
7663	EWUL 18, REVERSAL ANGLE > 6.12 DEG	S	260001422	01011	000000000	0001100010010	J8513
7664	EWUL 19, REVERSAL ANGLE > 7.51 DEG	S	260001423	01011	000000000	0001100010011	J8513
7665	EWUL 20, REVERSAL ANGLE > 8.91 DEG	S	260001424	01011	000000000	0001100010100	J8513
7666	EWUL 21, REVERSAL ANGLE > 10.30 DEG	S	260001425	01011	000000000	0001100010101	J8513
7667	EWUL 22, REVERSAL ANGLE > 11.70 DEG	S	260001426	01011	000000000	0001100010110	J8513
7668	EWUL 23, REVERSAL ANGLE > 13.09 DEG	S	260001427	01011	000000000	0001100010111	J8513
7669	EWUL 24, REVERSAL ANGLE > 14.49 DEG	S	260001430	01011	000000000	0001100011000	J8513
7670	EWUL 25, REVERSAL ANGLE > 15.88 DEG	S	260001431	01011	000000000	0001100011001	J8513
7671	EWUL 26, REVERSAL ANGLE > 17.28 DEG	S	260001432	01011	000000000	0001100011010	J8513
7672	EWUL 27, REVERSAL ANGLE > 18.67 DEG	S	260001433	01011	000000000	0001100011011	J8513
7673	EWUL 28, REVERSAL ANGLE > 20.07 DEG	S	260001434	01011	000000000	0001100011100	J8513
7674	EWUL 29, REVERSAL ANGLE > 21.47 DEG	S	260001435	01011	000000000	0001100011101	J8513
7675	EWUL 30, REVERSAL ANGLE > 22.86 DEG	S	260001436	01011	000000000	0001100011110	J8513
7676	EWUL 31, REVERSAL ANGLE > 24.26 DEG	S	260001437	01011	000000000	0001100011111	J8513
7677	EWUL 32, REVERSAL ANGLE > 25.65 DEG	S	260001440	01011	000000000	0001100100000	J8513
7678	EWUL 33, REVERSAL ANGLE > 27.05 DEG	S	260001441	01011	000000000	0001100100001	J8513

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

$ CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7679	EWUL 34, REVERSAL ANGLE > 28.44 DEG	S	260001442	01011	000000000	0001100100010	J8513
7680	EWUL 35, REVERSAL ANGLE > 29.84 DEG	S	260001443	01011	000000000	0001100100011	J8513
7681	EWUL 36, REVERSAL ANGLE > 31.23 DEG	S	260001444	01011	000000000	0001100100100	J8513
7682	EWUL 37, REVERSAL ANGLE > 32.63 DEG	S	260001445	01011	000000000	0001100100101	J8513
7683	EWUL 38, REVERSAL ANGLE > 34.02 DEG	S	260001446	01011	000000000	0001100100110	J8513
7684	EWUL 39, REVERSAL ANGLE > 35.42 DEG	S	260001447	01011	000000000	0001100100111	J8513
7685	EWUL 40, REVERSAL ANGLE > 36.81 DEG	S	260001450	01011	000000000	0001100101000	J8513
7686	EWUL 41, REVERSAL ANGLE > 38.21 DEG	S	260001451	01011	000000000	0001100101001	J8513
7687	EWUL 42, REVERSAL ANGLE > 39.60 DEG	S	260001452	01011	000000000	0001100101010	J8513
7688	EWUL 43, REVERSAL ANGLE > 41.00 DEG	S	260001453	01011	000000000	0001100101011	J8513
7689	EWUL 44, REVERSAL ANGLE > 42.40 DEG	S	260001454	01011	000000000	0001100101100	J8513
7690	EWUL 45, REVERSAL ANGLE > 43.79 DEG	S	260001455	01011	000000000	0001100101101	J8513
7691	EWUL 46, REVERSAL ANGLE > 45.19 DEG	S	260001456	01011	000000000	0001100101110	J8513
7692	EWUL 47, REVERSAL ANGLE > 46.58 DEG	S	260001457	01011	000000000	0001100101111	J8513
7693	EWUL 48, REVERSAL ANGLE > 47.98 DEG	S	260001460	01011	000000000	0001100110000	J8513
7694	EWUL 49, REVERSAL ANGLE > 49.37 DEG	S	260001461	01011	000000000	0001100110001	J8513
7695	EWUL 50, REVERSAL ANGLE > 50.77 DEG	S	260001462	01011	000000000	0001100110010	J8513
7696	EWUL 51, REVERSAL ANGLE > 52.16 DEG	S	260001463	01011	000000000	0001100110011	J8513
7697	EWUL 52, REVERSAL ANGLE > 53.56 DEG	S	260001464	01011	000000000	0001100110100	J8513
7698	EWUL 53, REVERSAL ANGLE > 54.95 DEG	S	260001465	01011	000000000	0001100110101	J8513
7699	EWUL 54, REVERSAL ANGLE > 56.35 DEG	S	260001466	01011	000000000	0001100110110	J8513
7700	EWUL 55, REVERSAL ANGLE > 57.74 DEG	S	260001467	01011	000000000	0001100110111	J8513
7701	EWUL 56, REVERSAL ANGLE > 59.14 DEG	S	260001470	01011	000000000	0001100111000	J8513
7702	EWUL 57, REVERSAL ANGLE > 60.53 DEG	S	260001471	01011	000000000	0001100111001	J8513
7703	EWUL 58, REVERSAL ANGLE > 61.93 DEG	S	260001472	01011	000000000	0001100111010	J8513
7704	EWUL 59, REVERSAL ANGLE > 63.33 DEG	S	260001473	01011	000000000	0001100111011	J8513
7705	EWUL 60, REVERSAL ANGLE > 64.72 DEG	S	260001474	01011	000000000	0001100111100	J8513
7706	EWUL 61, REVERSAL ANGLE > 66.12 DEG	S	260001475	01011	000000000	0001100111101	J8513
7707	EWUL 62, REVERSAL ANGLE > 67.51 DEG	S	260001476	01011	000000000	0001100111110	J8513
7708	EWUL 63, REVERSAL ANGLE > 68.91 DEG	S	260001477	01011	000000000	0001100111111	J8513
7709	EWUL 64, REVERSAL ANGLE > 70.30 DEG	S	260001500	01011	000000000	0001101000000	J8513
7710	EWUL 65, REVERSAL ANGLE > 71.70 DEG	S	260001501	01011	000000000	0001101000001	J8513
7711	EWUL 66, REVERSAL ANGLE > 73.09 DEG	S	260001502	01011	000000000	0001101000010	J8513
7712	EWUL 67, REVERSAL ANGLE > 74.49 DEG	S	260001503	01011	000000000	0001101000011	J8513
7713	EWUL 68, REVERSAL ANGLE > 75.88 DEG	S	260001504	01011	000000000	0001101000100	J8513
7714	EWUL 69, REVERSAL ANGLE > 77.28 DEG	S	260001505	01011	000000000	0001101000101	J8513
7715	EWUL 70, REVERSAL ANGLE > 78.67 DEG	S	260001506	01011	000000000	0001101000110	J8513
7716	EWUL 71, REVERSAL ANGLE > 80.07 DEG	S	260001507	01011	000000000	0001101000111	J8513
7717	EWUL 72, REVERSAL ANGLE > 81.47 DEG	S	260001510	01011	000000000	0001101001000	J8513
7718	EWUL 73, REVERSAL ANGLE > 82.86 DEG	S	260001511	01011	000000000	0001101001001	J8513
7719	EWUL 74, REVERSAL ANGLE > 84.26 DEG	S	260001512	01011	000000000	0001101001010	J8513
7720	EWUL 75, REVERSAL ANGLE > 85.65 DEG	S	260001513	01011	000000000	0001101001011	J8513
7721	EWUL 76, REVERSAL ANGLE > 87.05 DEG	S	260001514	01011	000000000	0001101001100	J8513
7722	EWUL 77, REVERSAL ANGLE > 88.44 DEG	S	260001515	01011	000000000	0001101001101	J8513
7723	EWUL 78, REVERSAL ANGLE > 89.84 DEG	S	260001516	01011	000000000	0001101001110	J8513
7724	EWUL 79, REVERSAL ANGLE > 91.23 DEG	S	260001517	01011	000000000	0001101001111	J8513
7725	EWUL 80, REVERSAL ANGLE > 92.63 DEG	S	260001520	01011	000000000	0001101010000	J8513
7726	EWUL 81, REVERSAL ANGLE > 94.02 DEG	S	260001521	01011	000000000	0001101010001	J8513
7727	EWUL 82, REVERSAL ANGLE > 95.42 DEG	S	260001522	01011	000000000	0001101010010	J8513
7728	EWUL 83, REVERSAL ANGLE > 96.81 DEG	S	260001523	01011	000000000	0001101010011	J8513

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7729	EWUL 84, REVERSAL ANGLE > 98.21 DEG	S	260001524	01011	000000000	0001101010100	J8513
7730	EWUL 85, REVERSAL ANGLE > 99.60 DEG	S	260001525	01011	000000000	0001101010101	J8513
7731	EWUL 86, REVERSAL ANGLE > 101.00 DEG	S	260001526	01011	000000000	0001101010110	J8513
7732	EWUL 87, REVERSAL ANGLE > 102.40 DEG	S	260001527	01011	000000000	0001101010111	J8513
7733	EWUL 88, REVERSAL ANGLE > 103.79 DEG	S	260001530	01011	000000000	0001101011000	J8513
7734	EWUL 89, REVERSAL ANGLE > 105.19 DEG	S	260001531	01011	000000000	0001101011001	J8513
7735	EWUL 90, REVERSAL ANGLE > 106.58 DEG	S	260001532	01011	000000000	0001101011010	J8513
7736	EWUL 91, REVERSAL ANGLE > 107.98 DEG	S	260001533	01011	000000000	0001101011011	J8513
7737	EWUL 92, REVERSAL ANGLE > 109.37 DEG	S	260001534	01011	000000000	0001101011100	J8513
7738	EWUL 93, REVERSAL ANGLE > 110.77 DEG	S	260001535	01011	000000000	0001101011101	J8513
7739	EWUL 94, REVERSAL ANGLE > 112.16 DEG	S	260001536	01011	000000000	0001101011110	J8513
7740	EWUL 95, REVERSAL ANGLE > 113.56 DEG	S	260001537	01011	000000000	0001101011111	J8513
7741	EWUL 96, REVERSAL ANGLE > 114.95 DEG	S	260001540	01011	000000000	0001101100000	J8513
7742	EWUL 97, REVERSAL ANGLE > 116.35 DEG	S	260001541	01011	000000000	0001101100001	J8513
7743	EWUL 98, REVERSAL ANGLE > 117.74 DEG	S	260001542	01011	000000000	0001101100010	J8513
7744	EWUL 99, REVERSAL ANGLE > 119.14 DEG	S	260001543	01011	000000000	0001101100011	J8513
7745	EWUL 100, REVERSAL ANGLE > 120.53 DEG	S	260001544	01011	000000000	0001101100100	J8513
7746	EWUL 101, REVERSAL ANGLE > 121.93 DEG	S	260001545	01011	000000000	0001101100101	J8513
7747	EWUL 102, REVERSAL ANGLE > 123.33 DEG	S	260001546	01011	000000000	0001101100110	J8513
7748	EWUL 103, REVERSAL ANGLE > 124.72 DEG	S	260001547	01011	000000000	0001101100111	J8513
7749	EWUL 104, REVERSAL ANGLE > 126.12 DEG	S	260001550	01011	000000000	0001101101000	J8513
7750	EWUL 105, REVERSAL ANGLE > 127.51 DEG	S	260001551	01011	000000000	0001101101001	J8513
7751	EWUL 106, REVERSAL ANGLE > 128.91 DEG	S	260001552	01011	000000000	0001101101010	J8513
7752	EWUL 107, REVERSAL ANGLE > 130.30 DEG	S	260001553	01011	000000000	0001101101011	J8513
7753	EWUL 108, REVERSAL ANGLE > 131.70 DEG	S	260001554	01011	000000000	0001101101100	J8513
7754	EWUL 109, REVERSAL ANGLE > 133.09 DEG	S	260001555	01011	000000000	0001101101101	J8513
7755	EWUL 110, REVERSAL ANGLE > 134.49 DEG	S	260001556	01011	000000000	0001101101110	J8513
7756	EWUL 111, REVERSAL ANGLE > 135.88 DEG	S	260001557	01011	000000000	0001101101111	J8513
7757	EWUL 112, REVERSAL ANGLE > 137.28 DEG	S	260001560	01011	000000000	0001101110000	J8513
7758	EWUL 113, REVERSAL ANGLE > 138.67 DEG	S	260001561	01011	000000000	0001101110001	J8513
7759	EWUL 114, REVERSAL ANGLE > 140.07 DEG	S	260001562	01011	000000000	0001101110010	J8513
7760	EWUL 115, REVERSAL ANGLE > 141.47 DEG	S	260001563	01011	000000000	0001101110011	J8513
7761	EWUL 116, REVERSAL ANGLE > 142.86 DEG	S	260001564	01011	000000000	0001101110100	J8513
7762	EWUL 117, REVERSAL ANGLE > 144.26 DEG	S	260001565	01011	000000000	0001101110101	J8513
7763	EWUL 118, REVERSAL ANGLE > 145.65 DEG	S	260001566	01011	000000000	0001101110110	J8513
7764	EWUL 119, REVERSAL ANGLE > 147.05 DEG	S	260001567	01011	000000000	0001101110111	J8513
7765	EWUL 120, REVERSAL ANGLE > 148.44 DEG	S	260001570	01011	000000000	0001101111000	J8513
7766	EWUL 121, REVERSAL ANGLE > 149.84 DEG	S	260001571	01011	000000000	0001101111001	J8513
7767	EWUL 122, REVERSAL ANGLE > 151.23 DEG	S	260001572	01011	000000000	0001101111010	J8513
7768	EWUL 123, REVERSAL ANGLE > 152.63 DEG	S	260001573	01011	000000000	0001101111011	J8513
7769	EWUL 124, REVERSAL ANGLE > 154.02 DEG	S	260001574	01011	000000000	0001101111100	J8513
7770	EWUL 125, REVERSAL ANGLE > 155.42 DEG	S	260001575	01011	000000000	0001101111101	J8513
7771	EWUL 126, REVERSAL ANGLE > 156.81 DEG	S	260001576	01011	000000000	0001101111110	J8513
7772	EWUL 127, REVERSAL ANGLE > 158.21 DEG	S	260001577	01011	000000000	0001101111111	J8513
7773	EWUL 128, REVERSAL ANGLE > 159.60 DEG	S	260001600	01011	000000000	0001110000000	J8513
7774	EWUL 129, REVERSAL ANGLE > 161.00 DEG	S	260001601	01011	000000000	0001110000001	J8513
7775	EWUL 130, REVERSAL ANGLE > 162.40 DEG	S	260001602	01011	000000000	0001110000010	J8513
7776	EWUL 131, REVERSAL ANGLE > 163.79 DEG	S	260001603	01011	000000000	0001110000011	J8513
7777	EWUL 132, REVERSAL ANGLE > 165.19 DEG	S	260001604	01011	000000000	0001110000100	J8513
7778	EWUL 133, REVERSAL ANGLE > 166.58 DEG	S	260001605	01011	000000000	0001110000101	J8513

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

$ CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7779	EWUL 134, REVERSAL ANGLE > 167.98 DEG	S	260001606	01011	000000000	000111000110	J8513
7780	EWUL 135, REVERSAL ANGLE > 169.37 DEG	S	260001607	01011	000000000	000111000111	J8513
7781	EWUL 136, REVERSAL ANGLE > 170.77 DEG	S	260001610	01011	000000000	000111001000	J8513
7782	EWUL 137, REVERSAL ANGLE > 172.16 DEG	S	260001611	01011	000000000	000111001001	J8513
7783	EWUL 138, REVERSAL ANGLE > 173.56 DEG	S	260001612	01011	000000000	000111001010	J8513
7784	EWUL 139, REVERSAL ANGLE > 174.95 DEG	S	260001613	01011	000000000	000111001011	J8513
7785	EWUL 140, REVERSAL ANGLE > 176.35 DEG	S	260001614	01011	000000000	000111001100	J8513
7786	EWUL 141, REVERSAL ANGLE > 177.74 DEG	S	260001615	01011	000000000	000111001101	J8513
7787	EWUL 142, REVERSAL ANGLE > 179.14 DEG	S	260001616	01011	000000000	000111001110	J8513
7788	EWUL 143, REVERSAL ANGLE > 180.53 DEG	S	260001617	01011	000000000	000111001111	J8513
7789	EWUL 144, REVERSAL ANGLE > 181.93 DEG	S	260001620	01011	000000000	000111010000	J8513
7790	EWUL 145, REVERSAL ANGLE > 183.33 DEG	S	260001621	01011	000000000	000111010001	J8513
7791	EWUL 146, REVERSAL ANGLE > 184.72 DEG	S	260001622	01011	000000000	000111010010	J8513
7792	EWUL 147, REVERSAL ANGLE > 186.12 DEG	S	260001623	01011	000000000	000111010011	J8513
7793	EWUL 148, REVERSAL ANGLE > 187.51 DEG	S	260001624	01011	000000000	000111010100	J8513
7794	EWUL 149, REVERSAL ANGLE > 188.91 DEG	S	260001625	01011	000000000	000111010101	J8513
7795	EWUL 150, REVERSAL ANGLE > 190.30 DEG	S	260001626	01011	000000000	000111010110	J8513
7796	EWUL 151, REVERSAL ANGLE > 191.70 DEG	S	260001627	01011	000000000	000111010111	J8513
7797	EWUL 152, REVERSAL ANGLE > 193.09 DEG	S	260001630	01011	000000000	000111011000	J8513
7798	EWUL 153, REVERSAL ANGLE > 194.49 DEG	S	260001631	01011	000000000	000111011001	J8513
7799	EWUL 154, REVERSAL ANGLE > 195.88 DEG	S	260001632	01011	000000000	000111011010	J8513
7800	EWUL 155, REVERSAL ANGLE > 197.28 DEG	S	260001633	01011	000000000	000111011011	J8513
7801	EWUL 156, REVERSAL ANGLE > 198.67 DEG	S	260001634	01011	000000000	000111011100	J8513
7802	EWUL 157, REVERSAL ANGLE > 200.07 DEG	S	260001635	01011	000000000	000111011101	J8513
7803	EWUL 158, REVERSAL ANGLE > 201.47 DEG	S	260001636	01011	000000000	000111011110	J8513
7804	EWUL 159, REVERSAL ANGLE > 202.86 DEG	S	260001637	01011	000000000	000111011111	J8513
7805	EWUL 160, REVERSAL ANGLE > 204.26 DEG	S	260001640	01011	000000000	000111100000	J8513
7806	EWUL 161, REVERSAL ANGLE > 205.65 DEG	S	260001641	01011	000000000	000111100001	J8513
7807	EWUL 162, REVERSAL ANGLE > 207.05 DEG	S	260001642	01011	000000000	000111100010	J8513
7808	EWUL 163, REVERSAL ANGLE > 208.44 DEG	S	260001643	01011	000000000	000111100011	J8513
7809	EWUL 164, REVERSAL ANGLE > 209.84 DEG	S	260001644	01011	000000000	000111100100	J8513
7810	EWUL 165, REVERSAL ANGLE > 211.23 DEG	S	260001645	01011	000000000	000111100101	J8513
7811	EWUL 166, REVERSAL ANGLE > 212.63 DEG	S	260001646	01011	000000000	000111100110	J8513
7812	EWUL 167, REVERSAL ANGLE > 214.02 DEG	S	260001647	01011	000000000	000111100111	J8513
7813	EWUL 168, REVERSAL ANGLE > 215.42 DEG	S	260001650	01011	000000000	000111101000	J8513
7814	EWUL 169, REVERSAL ANGLE > 216.81 DEG	S	260001651	01011	000000000	000111101001	J8513
7815	EWUL 170, REVERSAL ANGLE > 218.21 DEG	S	260001652	01011	000000000	000111101010	J8513
7816	EWUL 171, REVERSAL ANGLE > 219.60 DEG	S	260001653	01011	000000000	000111101011	J8513
7817	EWUL 172, REVERSAL ANGLE > 221.00 DEG	S	260001654	01011	000000000	000111101100	J8513
7818	EWUL 173, REVERSAL ANGLE > 222.40 DEG	S	260001655	01011	000000000	000111101101	J8513
7819	EWUL 174, REVERSAL ANGLE > 223.79 DEG	S	260001656	01011	000000000	000111101110	J8513
7820	EWUL 175, REVERSAL ANGLE > 225.19 DEG	S	260001657	01011	000000000	000111101111	J8513
7821	EWUL 176, REVERSAL ANGLE > 226.58 DEG	S	260001660	01011	000000000	000111110000	J8513
7822	EWUL 177, REVERSAL ANGLE > 227.98 DEG	S	260001661	01011	000000000	000111110001	J8513
7823	EWUL 178, REVERSAL ANGLE > 229.37 DEG	S	260001662	01011	000000000	000111110010	J8513
7824	EWUL 179, REVERSAL ANGLE > 230.77 DEG	S	260001663	01011	000000000	000111110011	J8513
7825	EWUL 180, REVERSAL ANGLE > 232.16 DEG	S	260001664	01011	000000000	000111110100	J8513
7826	EWUL 0, FORCED REVERSAL ANGLE	S	260001400	01011	000000000	000110000000	J8513
7827	EWUL 255, FORCED REVERSAL ANGLE	S	260001777	01011	000000000	000111111111	J8513
7828	NORTH/SOUTH PARK IMMEDIATE	S	260002000	01011	000000000	001000000000	J8569

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P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(N))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME		STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	7829	NORTH/SOUTH PARK AT 90 DEGREES		S	260002240	01011	000000000	0010010100000	J8569
	7830	NS SWEEP BETWEEN OPTICAL LIMITS		S	260002244	01011	000000000	0010010100100	J8569
	7831	NORTH/SOUTH PARK AT -20 DEGREES		S	260002245	01011	000000000	0010010100101	J8569
	7832	NORTH/SOUTH PARK AT 0 DEGREES		S	260002246	01011	000000000	0010010100110	J8569
	7833	NORTH/SOUTH PARK AT 180 DEGREES		S	260002254	01011	000000000	0010010101100	J8569
	7834	NORTH/SOUTH PARK AT 200 DEGREES		S	260002264	01011	000000000	0010010110100	J8569
	7835	NS WAG BETWEEN UPPER AND LOWER LIMITS		S	260002344	01011	000000000	0010011100100	J8569
	7836	EAST/WEST PARK IMMEDIATE		S	260002400	01011	000000000	0010100000000	J8570
	7837	EAST/WEST PARK AT 90 DEGREES		S	260002640	01011	000000000	0010110100000	J8570
	7838	EW SWEEP BETWEEN OPTICAL LIMITS		S	260002644	01011	000000000	0010110100100	J8570
	7839	EAST/WEST PARK AT -20 DEGREES		S	260002645	01011	000000000	0010110100101	J8570
	7840	EAST/WEST PARK AT 0 DEGREES		S	260002646	01011	000000000	0010110100110	J8570
	7841	EAST/WEST PARK AT 180 DEGREES		S	260002654	01011	000000000	0010110101100	J8570
	7842	EAST/WEST PARK AT 200 DEGREES		S	260002664	01011	000000000	0010110110100	J8570
	7843	EW WAG BETWEEN UPPER AND LOWER LIMITS		S	260002744	01011	000000000	0010111100100	J8570
	7844	SCAN ONLY		S	260003000	01011	000000000	0011000000000	
	7845	DWELL TIME 128=64 SECONDS	128	S	260003200	01011	000000000	0011010000000	J8532
	7846	DWELL TIME 129=63 SECONDS	127	S	260003201	01011	000000000	0011010000001	J8532
	7847	DWELL TIME 130=62 SECONDS	126	S	260003202	01011	000000000	0011010000010	J8532
	7848	DWELL TIME 131=61 SECONDS	125	S	260003203	01011	000000000	0011010000011	J8532
	7849	DWELL TIME 132=60 SECONDS	124	S	260003204	01011	000000000	0011010000100	J8532
	7850	DWELL TIME 133=59 SECONDS	123	S	260003205	01011	000000000	0011010000101	J8532
	7851	DWELL TIME 134=58 SECONDS	122	S	260003206	01011	000000000	0011010000110	J8532
	7852	DWELL TIME 135=57 SECONDS	121	S	260003207	01011	000000000	0011010000111	J8532
	7853	DWELL TIME 136=56 SECONDS	120	S	260003210	01011	000000000	0011010001000	J8532
	7854	DWELL TIME 137=55 SECONDS	119	S	260003211	01011	000000000	0011010001001	J8532
	7855	DWELL TIME 138=54 SECONDS	118	S	260003212	01011	000000000	0011010001010	J8532
	7856	DWELL TIME 139=53 SECONDS	117	S	260003213	01011	000000000	0011010001011	J8532
	7857	DWELL TIME 140=52 SECONDS	116	S	260003214	01011	000000000	0011010001100	J8532
	7858	DWELL TIME 141=51 SECONDS	115	S	260003215	01011	000000000	0011010001101	J8532
	7859	DWELL TIME 142=50 SECONDS	114	S	260003216	01011	000000000	0011010001110	J8532
	7860	DWELL TIME 143=49 SECONDS	113	S	260003217	01011	000000000	0011010001111	J8532
	7861	DWELL TIME 144=48 SECONDS	112	S	260003220	01011	000000000	0011010010000	J8532
	7862	DWELL TIME 145=47 SECONDS	111	S	260003221	01011	000000000	0011010010001	J8532
	7863	DWELL TIME 146=46 SECONDS	110	S	260003222	01011	000000000	0011010010010	J8532
	7864	DWELL TIME 147=45 SECONDS	109	S	260003223	01011	000000000	0011010010011	J8532
	7865	DWELL TIME 148=44 SECONDS	108	S	260003224	01011	000000000	0011010010100	J8532
	7866	DWELL TIME 149=43 SECONDS	107	S	260003225	01011	000000000	0011010010101	J8532
	7867	DWELL TIME 150=42 SECONDS	106	S	260003226	01011	000000000	0011010010110	J8532
	7868	DWELL TIME 151=41 SECONDS	105	S	260003227	01011	000000000	0011010010111	J8532
	7869	DWELL TIME 152=40 SECONDS	104	S	260003230	01011	000000000	0011010011000	J8532
	7870	DWELL TIME 153=39 SECONDS	103	S	260003231	01011	000000000	0011010011001	J8532
	7871	DWELL TIME 154=38 SECONDS	102	S	260003232	01011	000000000	0011010011010	J8532
	7872	DWELL TIME 155=37 SECONDS	101	S	260003233	01011	000000000	0011010011011	J8532
	7873	DWELL TIME 156=36 SECONDS	100	S	260003234	01011	000000000	0011010011100	J8532
	7874	DWELL TIME 157=35 SECONDS	99	S	260003235	01011	000000000	0011010011101	J8532
	7875	DWELL TIME 158=34 SECONDS	98	S	260003236	01011	000000000	0011010011110	J8532
	7876	DWELL TIME 159=33 SECONDS	97	S	260003237	01011	000000000	0011010011111	J8532
	7877	DWELL TIME 160=32 SECONDS	96	S	260003240	01011	000000000	0011010100000	J8532
	7878	DWELL TIME 161=31 SECONDS	95	S	260003241	01011	000000000	0011010100001	J8532

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P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
7879	DWELL TIME 162=30 SECONDS 94	S	260003242	01011	000000000	001101010010	J8532
7880	DWELL TIME 163=29 SECONDS 93	S	260003243	01011	000000000	001101010011	J8532
7881	DWELL TIME 164=28 SECONDS 92	S	260003244	01011	000000000	001101010100	J8532
7882	DWELL TIME 165=27 SECONDS 91	S	260003245	01011	000000000	001101010101	J8532
7883	DWELL TIME 166=26 SECONDS 90	S	260003246	01011	000000000	001101010110	J8532
7884	DWELL TIME 167=25 SECONDS 89	S	260003247	01011	000000000	001101010111	J8532
7885	DWELL TIME 168=24 SECONDS 88	S	260003250	01011	000000000	001101011000	J8532
7886	DWELL TIME 169=23 SECONDS 87	S	260003251	01011	000000000	001101011001	J8532
7887	DWELL TIME 170=22 SECONDS 86	S	260003252	01011	000000000	001101011010	J8532
7888	DWELL TIME 171=21 SECONDS 85	S	260003253	01011	000000000	001101011011	J8532
7889	DWELL TIME 172=20 SECONDS 84	S	260003254	01011	000000000	001101011100	J8532
7890	DWELL TIME 173=19 SECONDS 83	S	260003255	01011	000000000	001101011101	J8532
7891	DWELL TIME 174=18 SECONDS 82	S	260003256	01011	000000000	001101011110	J8532
7892	DWELL TIME 175=17 SECONDS 81	S	260003257	01011	000000000	001101011111	J8532
7893	DWELL TIME 176=16 SECONDS 80	S	260003260	01011	000000000	001101100000	J8532
7894	DWELL TIME 177=15 SECONDS 79	S	260003261	01011	000000000	001101100001	J8532
7895	DWELL TIME 178=14 SECONDS 78	S	260003262	01011	000000000	001101100010	J8532
7896	DWELL TIME 179=13 SECONDS 77	S	260003263	01011	000000000	001101100011	J8532
7897	DWELL TIME 180=12 SECONDS 76	S	260003264	01011	000000000	001101100100	J8532
7898	DWELL TIME 181=11 SECONDS 75	S	260003265	01011	000000000	001101100101	J8532
7899	DWELL TIME 182=10 SECONDS 74	S	260003266	01011	000000000	001101100110	J8532
7900	DWELL TIME 183=9 SECONDS 73	S	260003267	01011	000000000	001101100111	J8532
7901	DWELL TIME 184=8 SECONDS 72	S	260003270	01011	000000000	001101101000	J8532
7902	DWELL TIME 185=7 SECONDS 71	S	260003271	01011	000000000	001101101001	J8532
7903	DWELL TIME 186=6 SECONDS 70	S	260003272	01011	000000000	001101101010	J8532
7904	DWELL TIME 187=5 SECONDS 69	S	260003273	01011	000000000	001101101011	J8532
7905	DWELL TIME 188=4 SECONDS 68	S	260003274	01011	000000000	001101101100	J8532
7906	DWELL TIME 189=3 SECONDS 67	S	260003275	01011	000000000	001101101101	J8532
7907	DWELL TIME 190=2 SECONDS 66	S	260003276	01011	000000000	001101101110	J8532
7908	DWELL TIME 191=1 SECOND 65	S	260003277	01011	000000000	001101101111	J8532
7909	DWELL TIME 192=64 SECONDS	S	260003300	01011	000000000	001101110000	J8532
7910	DWELL TIME 193=63 SECONDS	S	260003301	01011	000000000	001101110001	J8532
7911	DWELL TIME 194=62 SECONDS	S	260003302	01011	000000000	001101110010	J8532
7912	DWELL TIME 195=61 SECONDS	S	260003303	01011	000000000	001101110011	J8532
7913	DWELL TIME 196=60 SECONDS	S	260003304	01011	000000000	001101110100	J8532
7914	DWELL TIME 197=59 SECONDS	S	260003305	01011	000000000	001101110101	J8532
7915	DWELL TIME 198=58 SECONDS	S	260003306	01011	000000000	001101110110	J8532
7916	DWELL TIME 199=57 SECONDS	S	260003307	01011	000000000	001101110111	J8532
7917	DWELL TIME 200=56 SECONDS	S	260003310	01011	000000000	001101111000	J8532
7918	DWELL TIME 201=55 SECONDS	S	260003311	01011	000000000	001101111001	J8532
7919	DWELL TIME 202=54 SECONDS	S	260003312	01011	000000000	001101111010	J8532
7920	DWELL TIME 203=53 SECONDS	S	260003313	01011	000000000	001101111011	J8532
7921	DWELL TIME 204=52 SECONDS	S	260003314	01011	000000000	001101111100	J8532
7922	DWELL TIME 205=51 SECONDS	S	260003315	01011	000000000	001101111101	J8532
7923	DWELL TIME 206=50 SECONDS	S	260003316	01011	000000000	001101111110	J8532
7924	DWELL TIME 207=49 SECONDS	S	260003317	01011	000000000	001101111111	J8532
7925	DWELL TIME 208=48 SECONDS	S	260003320	01011	000000000	001110000000	J8532
7926	DWELL TIME 209=47 SECONDS	S	260003321	01011	000000000	001110000001	J8532
7927	DWELL TIME 210=46 SECONDS	S	260003322	01011	000000000	001110000010	J8532
7928	DWELL TIME 211=45 SECONDS	S	260003323	01011	000000000	001110000011	J8532

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
	7929	DWELL TIME 212=44 SECONDS	S	260003324	01011 000000000 0011011010100	J8532
	7930	DWELL TIME 213=43 SECONDS	S	260003325	01011 000000000 0011011010101	J8532
	7931	DWELL TIME 214=42 SECONDS	S	260003326	01011 000000000 0011011010110	J8532
	7932	DWELL TIME 215=41 SECONDS	S	260003327	01011 000000000 0011011010111	J8532
	7933	DWELL TIME 216=40 SECONDS	S	260003330	01011 000000000 0011011011000	J8532
	7934	DWELL TIME 217=39 SECONDS	S	260003331	01011 000000000 0011011011001	J8532
	7935	DWELL TIME 218=38 SECONDS	S	260003332	01011 000000000 0011011011010	J8532
	7936	DWELL TIME 219=37 SECONDS	S	260003333	01011 000000000 0011011011011	J8532
	7937	DWELL TIME 220=36 SECONDS	S	260003334	01011 000000000 0011011011100	J8532
	7938	DWELL TIME 221=35 SECONDS	S	260003335	01011 000000000 0011011011101	J8532
	7939	DWELL TIME 222=34 SECONDS	S	260003336	01011 000000000 0011011011110	J8532
	7940	DWELL TIME 223=33 SECONDS	S	260003337	01011 000000000 0011011011111	J8532
	7941	DWELL TIME 224=32 SECONDS	S	260003340	01011 000000000 0011011100000	J8532
	7942	DWELL TIME 225=31 SECONDS	S	260003341	01011 000000000 0011011100001	J8532
	7943	DWELL TIME 226=30 SECONDS	S	260003342	01011 000000000 0011011100010	J8532
	7944	DWELL TIME 227=29 SECONDS	S	260003343	01011 000000000 0011011100011	J8532
	7945	DWELL TIME 228=28 SECONDS	S	260003344	01011 000000000 0011011100100	J8532
	7946	DWELL TIME 229=27 SECONDS	S	260003345	01011 000000000 0011011100101	J8532
	7947	DWELL TIME 230=26 SECONDS	S	260003346	01011 000000000 0011011100110	J8532
	7948	DWELL TIME 231=25 SECONDS	S	260003347	01011 000000000 0011011100111	J8532
	7949	DWELL TIME 232=24 SECONDS	S	260003350	01011 000000000 0011011101000	J8532
	7950	DWELL TIME 233=23 SECONDS	S	260003351	01011 000000000 0011011101001	J8532
	7951	DWELL TIME 234=22 SECONDS	S	260003352	01011 000000000 0011011101010	J8532
	7952	DWELL TIME 235=21 SECONDS	S	260003353	01011 000000000 0011011101011	J8532
	7953	DWELL TIME 236=20 SECONDS	S	260003354	01011 000000000 0011011101100	J8532
	7954	DWELL TIME 237=19 SECONDS	S	260003355	01011 000000000 0011011101101	J8532
	7955	DWELL TIME 238=18 SECONDS	S	260003356	01011 000000000 0011011101110	J8532
	7956	DWELL TIME 239=17 SECONDS	S	260003357	01011 000000000 0011011101111	J8532
	7957	DWELL TIME 240=16 SECONDS	S	260003360	01011 000000000 0011011110000	J8532
	7958	DWELL TIME 241=15 SECONDS	S	260003361	01011 000000000 0011011110001	J8532
	7959	DWELL TIME 242=14 SECONDS	S	260003362	01011 000000000 0011011110010	J8532
	7960	DWELL TIME 243=13 SECONDS	S	260003363	01011 000000000 0011011110011	J8532
	7961	DWELL TIME 244=12 SECONDS	S	260003364	01011 000000000 0011011110100	J8532
	7962	DWELL TIME 245=11 SECONDS	S	260003365	01011 000000000 0011011110101	J8532
	7963	DWELL TIME 246=10 SECONDS	S	260003366	01011 000000000 0011011110110	J8532
	7964	DWELL TIME 247=9 SECONDS	S	260003367	01011 000000000 0011011110111	J8532
	7965	DWELL TIME 248=8 SECONDS	S	260003370	01011 000000000 0011011111000	J8532
	7966	DWELL TIME 249=7 SECONDS	S	260003371	01011 000000000 0011011111001	J8532
	7967	DWELL TIME 250=6 SECONDS	S	260003372	01011 000000000 0011011111010	J8532
	7968	DWELL TIME 251=5 SECONDS	S	260003373	01011 000000000 0011011111011	J8532
	7969	DWELL TIME 252=4 SECONDS	S	260003374	01011 000000000 0011011111100	J8532
	7970	DWELL TIME 253=3 SECONDS	S	260003375	01011 000000000 0011011111101	J8532
	7971	DWELL TIME 254=2 SECONDS	S	260003376	01011 000000000 0011011111110	J8532
	7972	DWELL TIME 255=1 SECOND	S	260003377	01011 000000000 0011011111111	J8532
	7973	START DWELL NO. AT 64 DWELLS/CYCLE	S	260003400	01011 000000000 0011100000000	J8533
	7974	START DWELL NO. AT 62 DWELLS/CYCLE	S	260003401	01011 000000000 0011100000001	J8533
	7975	START DWELL NO. AT 60 DWELLS/CYCLE	S	260003402	01011 000000000 0011100000010	J8533
	7976	START DWELL NO. AT 58 DWELLS/CYCLE	S	260003403	01011 000000000 0011100000011	J8533
	7977	START DWELL NO. AT 56 DWELLS/CYCLE	S	260003404	01011 000000000 0011100000100	J8533
	7978	START DWELL NO. AT 54 DWELLS/CYCLE	S	260003405	01011 000000000 0011100000101	J8533

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
7979	START DWELL NO. AT 52 DWELLS/CYCLE	S	260003406	01011 000000000 0011100000110	J8533
7980	START DWELL NO. AT 50 DWELLS/CYCLE	S	260003407	01011 000000000 0011100000111	J8533
7981	START DWELL NO. AT 48 DWELLS/CYCLE	S	260003410	01011 000000000 0011100001000	J8533
7982	START DWELL NO. AT 46 DWELLS/CYCLE	S	260003411	01011 000000000 0011100001001	J8533
7983	START DWELL NO. AT 44 DWELLS/CYCLE	S	260003412	01011 000000000 0011100001010	J8533
7984	START DWELL NO. AT 42 DWELLS/CYCLE	S	260003413	01011 000000000 0011100001011	J8533
7985	START DWELL NO. AT 40 DWELLS/CYCLE	S	260003414	01011 000000000 0011100001100	J8533
7986	START DWELL NO. AT 38 DWELLS/CYCLE	S	260003415	01011 000000000 0011100001101	J8533
7987	START DWELL NO. AT 36 DWELLS/CYCLE	S	260003416	01011 000000000 0011100001110	J8533
7988	START DWELL NO. AT 34 DWELLS/CYCLE	S	260003417	01011 000000000 0011100001111	J8533
7989	START DWELL NO. AT 32 DWELLS/CYCLE	S	260003420	01011 000000000 0011100010000	J8533
7990	START DWELL NO. AT 30 DWELLS/CYCLE	S	260003421	01011 000000000 0011100010001	J8533
7991	START DWELL NO. AT 28 DWELLS/CYCLE	S	260003422	01011 000000000 0011100010010	J8533
7992	START DWELL NO. AT 26 DWELLS/CYCLE	S	260003423	01011 000000000 0011100010011	J8533
7993	START DWELL NO. AT 24 DWELLS/CYCLE	S	260003424	01011 000000000 0011100010100	J8533
7994	START DWELL NO. AT 22 DWELLS/CYCLE	S	260003425	01011 000000000 0011100010101	J8533
7995	START DWELL NO. AT 20 DWELLS/CYCLE	S	260003426	01011 000000000 0011100010110	J8533
7996	START DWELL NO. AT 18 DWELLS/CYCLE	S	260003427	01011 000000000 0011100010111	J8533
7997	START DWELL NO. AT 16 DWELLS/CYCLE	S	260003430	01011 000000000 0011100011000	J8533
7998	START DWELL NO. AT 14 DWELLS/CYCLE	S	260003431	01011 000000000 0011100011001	J8533
7999	START DWELL NO. AT 12 DWELLS/CYCLE	S	260003432	01011 000000000 0011100011010	J8533
8000	START DWELL NO. AT 10 DWELLS/CYCLE	S	260003433	01011 000000000 0011100011011	J8533
8001	START DWELL NO. AT 8 DWELLS/CYCLE	S	260003434	01011 000000000 0011100011100	J8533
8002	START DWELL NO. AT 6 DWELLS/CYCLE	S	260003435	01011 000000000 0011100011101	J8533
8003	START DWELL NO. AT 4 DWELLS/CYCLE	S	260003436	01011 000000000 0011100011110	J8533
8004	START DWELL NO. AT 2 DWELLS/CYCLE	S	260003437	01011 000000000 0011100011111	J8533
8005	PRESET DWELL NO. AT 64 DWELLS/CYCLE	S	260003440	01011 000000000 0011100100000	J8533
8006	PRESET DWELL NO. AT 62 DWELLS/CYCLE	S	260003441	01011 000000000 0011100100001	J8533
8007	PRESET DWELL NO. AT 60 DWELLS/CYCLE	S	260003442	01011 000000000 0011100100010	J8533
8008	PRESET DWELL NO. AT 58 DWELLS/CYCLE	S	260003443	01011 000000000 0011100100011	J8533
8009	PRESET DWELL NO. AT 56 DWELLS/CYCLE	S	260003444	01011 000000000 0011100100100	J8533
8010	PRESET DWELL NO. AT 54 DWELLS/CYCLE	S	260003445	01011 000000000 0011100100101	J8533
8011	PRESET DWELL NO. AT 52 DWELLS/CYCLE	S	260003446	01011 000000000 0011100100110	J8533
8012	PRESET DWELL NO. AT 50 DWELLS/CYCLE	S	260003447	01011 000000000 0011100100111	J8533
8013	PRESET DWELL NO. AT 48 DWELLS/CYCLE	S	260003450	01011 000000000 0011100101000	J8533
8014	PRESET DWELL NO. AT 46 DWELLS/CYCLE	S	260003451	01011 000000000 0011100101001	J8533
8015	PRESET DWELL NO. AT 44 DWELLS/CYCLE	S	260003452	01011 000000000 0011100101010	J8533
8016	PRESET DWELL NO. AT 42 DWELLS/CYCLE	S	260003453	01011 000000000 0011100101011	J8533
8017	PRESET DWELL NO. AT 40 DWELLS/CYCLE	S	260003454	01011 000000000 0011100101100	J8533
8018	PRESET DWELL NO. AT 38 DWELLS/CYCLE	S	260003455	01011 000000000 0011100101101	J8533
8019	PRESET DWELL NO. AT 36 DWELLS/CYCLE	S	260003456	01011 000000000 0011100101110	J8533
8020	PRESET DWELL NO. AT 34 DWELLS/CYCLE	S	260003457	01011 000000000 0011100101111	J8533
8021	PRESET DWELL NO. AT 32 DWELLS/CYCLE	S	260003460	01011 000000000 0011100110000	J8533
8022	PRESET DWELL NO. AT 30 DWELLS/CYCLE	S	260003461	01011 000000000 0011100110001	J8533
8023	PRESET DWELL NO. AT 28 DWELLS/CYCLE	S	260003462	01011 000000000 0011100110010	J8533
8024	PRESET DWELL NO. AT 26 DWELLS/CYCLE	S	260003463	01011 000000000 0011100110011	J8533
8025	PRESET DWELL NO. AT 24 DWELLS/CYCLE	S	260003464	01011 000000000 0011100110100	J8533
8026	PRESET DWELL NO. AT 22 DWELLS/CYCLE	S	260003465	01011 000000000 0011100110101	J8533
8027	PRESET DWELL NO. AT 20 DWELLS/CYCLE	S	260003466	01011 000000000 0011100110110	J8533
8028	PRESET DWELL NO. AT 18 DWELLS/CYCLE	S	260003467	01011 000000000 0011100110111	J8533

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
8029	PRESET DWELL NO. AT 16 DWELLS/CYCLE	S	260003470	01011	000000000	0011100111000	J8533
8030	PRESET DWELL NO. AT 14 DWELLS/CYCLE	S	260003471	01011	000000000	0011100111001	J8533
8031	PRESET DWELL NO. AT 12 DWELLS/CYCLE	S	260003472	01011	000000000	0011100111010	J8533
8032	PRESET DWELL NO. AT 10 DWELLS/CYCLE	S	260003473	01011	000000000	0011100111011	J8533
8033	PRESET DWELL NO. AT 8 DWELLS/CYCLE	S	260003474	01011	000000000	0011100111100	J8533
8034	PRESET DWELL NO. AT 6 DWELLS/CYCLE	S	260003475	01011	000000000	0011100111101	J8533
8035	PRESET DWELL NO. AT 4 DWELLS/CYCLE	S	260003476	01011	000000000	0011100111110	J8533
8036	PRESET DWELL NO. AT 2 DWELLS/CYCLE	S	260003477	01011	000000000	0011100111111	J8533
8037	INITIAL DWELL STEP=0	S	260004000	01011	000000000	0100000000000	J8534
8038	INITIAL DWELL STEP=1	S	260004001	01011	000000000	0100000000001	J8534
8039	INITIAL DWELL STEP=2	S	260004002	01011	000000000	0100000000010	J8534
8040	INITIAL DWELL STEP=3	S	260004003	01011	000000000	0100000000011	J8534
8041	INITIAL DWELL STEP=4	S	260004004	01011	000000000	0100000000100	J8534
8042	INITIAL DWELL STEP=5	S	260004005	01011	000000000	0100000000101	J8534
8043	INITIAL DWELL STEP=6	S	260004006	01011	000000000	0100000000110	J8534
8044	INITIAL DWELL STEP=7	S	260004007	01011	000000000	0100000000111	J8534
8045	INITIAL DWELL STEP=8	S	260004010	01011	000000000	0100000001000	J8534
8046	INITIAL DWELL STEP=9	S	260004011	01011	000000000	0100000001001	J8534
8047	INITIAL DWELL STEP=10	S	260004012	01011	000000000	0100000001010	J8534
8048	INITIAL DWELL STEP=11	S	260004013	01011	000000000	0100000001011	J8534
8049	INITIAL DWELL STEP=12	S	260004014	01011	000000000	0100000001100	J8534
8050	INITIAL DWELL STEP=13	S	260004015	01011	000000000	0100000001101	J8534
8051	INITIAL DWELL STEP=14	S	260004016	01011	000000000	0100000001110	J8534
8052	INITIAL DWELL STEP=15	S	260004017	01011	000000000	0100000001111	J8534
8053	INITIAL DWELL STEP=16	S	260004020	01011	000000000	0100000010000	J8534
8054	INITIAL DWELL STEP=17	S	260004021	01011	000000000	0100000010001	J8534
8055	INITIAL DWELL STEP=18	S	260004022	01011	000000000	0100000010010	J8534
8056	INITIAL DWELL STEP=19	S	260004023	01011	000000000	0100000010011	J8534
8057	INITIAL DWELL STEP=20	S	260004024	01011	000000000	0100000010100	J8534
8058	INITIAL DWELL STEP=21	S	260004025	01011	000000000	0100000010101	J8534
8059	INITIAL DWELL STEP=22	S	260004026	01011	000000000	0100000010110	J8534
8060	INITIAL DWELL STEP=23	S	260004027	01011	000000000	0100000010111	J8534
8061	INITIAL DWELL STEP=24	S	260004030	01011	000000000	0100000011000	J8534
8062	INITIAL DWELL STEP=25	S	260004031	01011	000000000	0100000011001	J8534
8063	INITIAL DWELL STEP=26	S	260004032	01011	000000000	0100000011010	J8534
8064	INITIAL DWELL STEP=27	S	260004033	01011	000000000	0100000011011	J8534
8065	INITIAL DWELL STEP=28	S	260004034	01011	000000000	0100000011100	J8534
8066	INITIAL DWELL STEP=29	S	260004035	01011	000000000	0100000011101	J8534
8067	INITIAL DWELL STEP=30	S	260004036	01011	000000000	0100000011110	J8534
8068	INITIAL DWELL STEP=31	S	260004037	01011	000000000	0100000011111	J8534
8069	INITIAL DWELL STEP=32	S	260004040	01011	000000000	0100000100000	J8534
8070	INITIAL DWELL STEP=33	S	260004041	01011	000000000	0100000100001	J8534
8071	INITIAL DWELL STEP=34	S	260004042	01011	000000000	0100000100010	J8534
8072	INITIAL DWELL STEP=35	S	260004043	01011	000000000	0100000100011	J8534
8073	INITIAL DWELL STEP=36	S	260004044	01011	000000000	0100000100100	J8534
8074	INITIAL DWELL STEP=37	S	260004045	01011	000000000	0100000100101	J8534
8075	INITIAL DWELL STEP=38	S	260004046	01011	000000000	0100000100110	J8534
8076	INITIAL DWELL STEP=39	S	260004047	01011	000000000	0100000100111	J8534
8077	INITIAL DWELL STEP=40	S	260004050	01011	000000000	0100000101000	J8534
8078	INITIAL DWELL STEP=41	S	260004051	01011	000000000	0100000101001	J8534

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	8079	INITIAL DWELL STEP=42	S	260004052	01011	000000000	0100000101010	J8534
	8080	INITIAL DWELL STEP=43	S	260004053	01011	000000000	0100000101011	J8534
	8081	INITIAL DWELL STEP=44	S	260004054	01011	000000000	0100000101100	J8534
	8082	INITIAL DWELL STEP=45	S	260004055	01011	000000000	0100000101101	J8534
	8083	INITIAL DWELL STEP=46	S	260004056	01011	000000000	0100000101110	J8534
	8084	INITIAL DWELL STEP=47	S	260004057	01011	000000000	0100000101111	J8534
	8085	INITIAL DWELL STEP=48	S	260004060	01011	000000000	0100000110000	J8534
	8086	INITIAL DWELL STEP=49	S	260004061	01011	000000000	0100000110001	J8534
	8087	INITIAL DWELL STEP=50	S	260004062	01011	000000000	0100000110010	J8534
	8088	INITIAL DWELL STEP=51	S	260004063	01011	000000000	0100000110011	J8534
	8089	INITIAL DWELL STEP=52	S	260004064	01011	000000000	0100000110100	J8534
	8090	INITIAL DWELL STEP=53	S	260004065	01011	000000000	0100000110101	J8534
	8091	INITIAL DWELL STEP=54	S	260004066	01011	000000000	0100000110110	J8534
	8092	INITIAL DWELL STEP=55	S	260004067	01011	000000000	0100000110111	J8534
	8093	INITIAL DWELL STEP=56	S	260004070	01011	000000000	0100000111000	J8534
	8094	INITIAL DWELL STEP=57	S	260004071	01011	000000000	0100000111001	J8534
	8095	INITIAL DWELL STEP=58	S	260004072	01011	000000000	0100000111010	J8534
	8096	INITIAL DWELL STEP=59	S	260004073	01011	000000000	0100000111011	J8534
	8097	INITIAL DWELL STEP=60	S	260004074	01011	000000000	0100000111100	J8534
	8098	INITIAL DWELL STEP=61	S	260004075	01011	000000000	0100000111101	J8534
	8099	INITIAL DWELL STEP=62	S	260004076	01011	000000000	0100000111110	J8534
	8100	INITIAL DWELL STEP=63	S	260004077	01011	000000000	0100000111111	J8534
	8101	DWELL STEP SIZE=1	S	260004401	01011	000000000	0100100000001	J8535
	8102	DWELL STEP SIZE=2	S	260004402	01011	000000000	0100100000010	J8535
	8103	DWELL STEP SIZE=4	S	260004404	01011	000000000	0100100000100	J8535
	8104	DWELL STEP SIZE=8	S	260004410	01011	000000000	0100100001000	J8535
	8105	DWELL STEP SIZE=16	S	260004420	01011	000000000	0100100010000	J8535
	8106	DWELL STEP SIZE=32	S	260004440	01011	000000000	0100100100000	J8535
	8107	3KHZ GATE=PNS;LO EN.=NO;NORMAL MODE	S	260005000	01011	000000000	0101000000000	J8538
	8108	3KHZ GATE=PNS;LO EN.=NO;FAST ION MODE	S	260005001	01011	000000000	0101000000001	J8538
	8109	3KHZ GATE=PNS;LO EN.=NO;FAST MIX MODE	S	260005002	01011	000000000	0101000000010	J8538
	8110	3KHZ GATE=PNS;LO EN.=NO;SFPNS MODE	S	260005003	01011	000000000	0101000000011	J8538
	8111	3KHZ GATE=PNS;LO EN.=NO;SFENS MODE	S	260005004	01011	000000000	0101000000100	J8538
	8112	3KHZ GATE=PNS;LO EN.=NO;SFPEW MODE	S	260005005	01011	000000000	0101000000101	J8538
	8113	3KHZ GATE=PNS;LO EN.=NO;SFEEW MODE	S	260005006	01011	000000000	0101000000110	J8538
	8114	3KHZ GATE=PNS;LO EN.=NO;SFPFIX MODE	S	260005007	01011	000000000	0101000000111	J8538
	8115	3KHZ GATE=PNS;LO EN.=YES;NORMAL MODE	S	260005010	01011	000000000	0101000001000	J8538
	8116	3KHZ GATE=PNS;LO EN.=YES;FAST ION MODE	S	260005011	01011	000000000	0101000001001	J8538
	8117	3KHZ GATE=PNS;LO EN.=YES;FAST MIX MODE	S	260005012	01011	000000000	0101000001010	J8538
	8118	3KHZ GATE=PNS;LO EN.=YES;SFPNS MODE	S	260005013	01011	000000000	0101000001011	J8538
	8119	3KHZ GATE=PNS;LO EN.=YES;SFENS MODE	S	260005014	01011	000000000	0101000001100	J8538
	8120	3KHZ GATE=PNS;LO EN.=YES;SFPEW MODE	S	260005015	01011	000000000	0101000001101	J8538
	8121	3KHZ GATE=PNS;LO EN.=YES;SFEEW MODE	S	260005016	01011	000000000	0101000001110	J8538
	8122	3KHZ GATE=PNS;LO EN.=YES;SFPFIX MODE	S	260005017	01011	000000000	0101000001111	J8538
	8123	3KHZ GATE=ENS;LO EN.=NO;NORMAL MODE	S	260005020	01011	000000000	0101000010000	J8538
	8124	3KHZ GATE=ENS;LO EN.=NO;FAST ION MODE	S	260005021	01011	000000000	0101000010001	J8538
	8125	3KHZ GATE=ENS;LO EN.=NO;FAST MIX MODE	S	260005022	01011	000000000	0101000010010	J8538
	8126	3KHZ GATE=ENS;LO EN.=NO;SFPNS MODE	S	260005023	01011	000000000	0101000010011	J8538
	8127	3KHZ GATE=ENS;LO EN.=NO;SFENS MODE	S	260005024	01011	000000000	0101000010100	J8538
	8128	3KHZ GATE=ENS;LO EN.=NO;SFPEW MODE	S	260005025	01011	000000000	0101000010101	J8538

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
	8129	3KHZ GATE=ENS;LO EN.=NO;SFEEW MODE	S	260005026	01011 000000000 010100010110	J8538
	8130	3KHZ GATE=ENS;LO EN.=NO;SFPFIX MODE	S	260005027	01011 000000000 010100010111	J8538
	8131	3KHZ GATE=ENS;LO EN.=YES;NORMAL MODE	S	260005030	01011 000000000 010100011000	J8538
	8132	3KHZ GATE=ENS;LO EN.=YES;FAST ION MODE	S	260005031	01011 000000000 010100011001	J8538
	8133	3KHZ GATE=ENS;LO EN.=YES;FAST MIX MODE	S	260005032	01011 000000000 010100011010	J8538
	8134	3KHZ GATE=ENS;LO EN.=YES;SFPNS MODE	S	260005033	01011 000000000 010100011011	J8538
	8135	3KHZ GATE=ENS;LO EN.=YES;SFENS MODE	S	260005034	01011 000000000 010100011100	J8538
	8136	3KHZ GATE=ENS;LO EN.=YES;SFPEW MODE	S	260005035	01011 000000000 010100011101	J8538
	8137	3KHZ GATE=ENS;LO EN.=YES;SFEEW MODE	S	260005036	01011 000000000 010100011110	J8538
	8138	3KHZ GATE=ENS;LO EN.=YES;SFPFIX MODE	S	260005037	01011 000000000 010100011111	J8538
	8139	3KHZ GATE=PEW;LO EN.=NO;NORMAL MODE	S	260005040	01011 000000000 010100100000	J8538
	8140	3KHZ GATE=PEW;LO EN.=NO;FAST ION MODE	S	260005041	01011 000000000 010100100001	J8538
	8141	3KHZ GATE=PEW;LO EN.=NO;FAST MIX MODE	S	260005042	01011 000000000 010100100010	J8538
	8142	3KHZ GATE=PEW;LO EN.=NO;SFPNS MODE	S	260005043	01011 000000000 010100100011	J8538
	8143	3KHZ GATE=PEW;LO EN.=NO;SFENS MODE	S	260005044	01011 000000000 010100100100	J8538
	8144	3KHZ GATE=PEW;LO EN.=NO;SFPEW MODE	S	260005045	01011 000000000 010100100101	J8538
	8145	3KHZ GATE=PEW;LO EN.=NO;SFEEW MODE	S	260005046	01011 000000000 010100100110	J8538
	8146	3KHZ GATE=PEW;LO EN.=NO;SFPFIX MODE	S	260005047	01011 000000000 010100100111	J8538
	8147	3KHZ GATE=PEW;LO EN.=YES;NORMAL MODE	S	260005050	01011 000000000 010100101000	J8538
	8148	3KHZ GATE=PEW;LO EN.=YES;FAST ION MODE	S	260005051	01011 000000000 010100101001	J8538
	8149	3KHZ GATE=PEW;LO EN.=YES;FAST MIX MODE	S	260005052	01011 000000000 010100101010	J8538
	8150	3KHZ GATE=PEW;LO EN.=YES;SFPNS MODE	S	260005053	01011 000000000 010100101011	J8538
	8151	3KHZ GATE=PEW;LO EN.=YES;SFENS MODE	S	260005054	01011 000000000 010100101100	J8538
	8152	3KHZ GATE=PEW;LO EN.=YES;SFPEW MODE	S	260005055	01011 000000000 010100101101	J8538
	8153	3KHZ GATE=PEW;LO EN.=YES;SFEEW MODE	S	260005056	01011 000000000 010100101110	J8538
	8154	3KHZ GATE=PEW;LO EN.=YES;SFPFIX MODE	S	260005057	01011 000000000 010100101111	J8538
	8155	3KHZ GATE=EEW;LO EN.=NO;NORMAL MODE	S	260005060	01011 000000000 010100110000	J8538
	8156	3KHZ GATE=EEW;LO EN.=NO;FAST ION MODE	S	260005061	01011 000000000 010100110001	J8538
	8157	3KHZ GATE=EEW;LO EN.=NO;FAST MIX MODE	S	260005062	01011 000000000 010100110010	J8538
	8158	3KHZ GATE=EEW;LO EN.=NO;SFPNS MODE	S	260005063	01011 000000000 010100110011	J8538
	8159	3KHZ GATE=EEW;LO EN.=NO;SFENS MODE	S	260005064	01011 000000000 010100110100	J8538
	8160	3KHZ GATE=EEW;LO EN.=NO;SFPEW MODE	S	260005065	01011 000000000 010100110101	J8538
	8161	3KHZ GATE=EEW;LO EN.=NO;SFEEW MODE	S	260005066	01011 000000000 010100110110	J8538
	8162	3KHZ GATE=EEW;LO EN.=NO;SFPFIX MODE	S	260005067	01011 000000000 010100110111	J8538
	8163	3KHZ GATE=EEW;LO EN.=YES;NORMAL MODE	S	260005070	01011 000000000 010100111000	J8538
	8164	3KHZ GATE=EEW;LO EN.=YES;FAST ION MODE	S	260005071	01011 000000000 010100111001	J8538
	8165	3KHZ GATE=EEW;LO EN.=YES;FAST MIX MODE	S	260005072	01011 000000000 010100111010	J8538
	8166	3KHZ GATE=EEW;LO EN.=YES;SFPNS MODE	S	260005073	01011 000000000 010100111011	J8538
	8167	3KHZ GATE=EEW;LO EN.=YES;SFENS MODE	S	260005074	01011 000000000 010100111100	J8538
	8168	3KHZ GATE=EEW;LO EN.=YES;SFPEW MODE	S	260005075	01011 000000000 010100111101	J8538
	8169	3KHZ GATE=EEW;LO EN.=YES;SFEEW MODE	S	260005076	01011 000000000 010100111110	J8538
	8170	3KHZ GATE=EEW;LO EN.=YES;SFPFIX MODE	S	260005077	01011 000000000 010100111111	J8538
	8171	3KHZ GATE=PFIX;LO EN.=NO;NORMAL MODE	S	260005100	01011 000000000 010101000000	J8538
	8172	3KHZ GATE=PFIX;LO EN.=NO;FAST ION MODE	S	260005101	01011 000000000 010101000001	J8538
	8173	3KHZ GATE=PFIX;LO EN.=NO;FAST MIX MODE	S	260005102	01011 000000000 010101000010	J8538
	8174	3KHZ GATE=PFIX;LO EN.=NO;SFPNS MODE	S	260005103	01011 000000000 010101000011	J8538
	8175	3KHZ GATE=PFIX;LO EN.=NO;SFENS MODE	S	260005104	01011 000000000 010101000100	J8538
	8176	3KHZ GATE=PFIX;LO EN.=NO;SFPEW MODE	S	260005105	01011 000000000 010101000101	J8538
	8177	3KHZ GATE=PFIX;LO EN.=NO;SFEEW MODE	S	260005106	01011 000000000 010101000110	J8538
	8178	3KHZ GATE=PFIX;LO EN.=NO;SFPFIX MODE	S	260005107	01011 000000000 010101000111	J8538

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32	TM VERIFICATION AND REFERENCE
8179	3KHZ GATE=PFIX;LO EN.=YES;NORMAL MODE	S	260005110	01011 000000000 0101001001000	J8538
8180	3KHZ GATE=PFIX;LO EN.=YES;FAST ION MODE	S	260005111	01011 000000000 0101001001001	J8538
8181	3KHZ GATE=PFIX;LO EN.=YES;FAST MIX MODE	S	260005112	01011 000000000 0101001001010	J8538
8182	3KHZ GATE=PFIX;LO EN.=YES;SFPNS MODE	S	260005113	01011 000000000 0101001001011	J8538
8183	3KHZ GATE=PFIX;LO EN.=YES;SFENS MODE	S	260005114	01011 000000000 0101001001100	J8538
8184	3KHZ GATE=PFIX;LO EN.=YES;SFPEW MODE	S	260005115	01011 000000000 0101001001101	J8538
8185	3KHZ GATE=PFIX;LO EN.=YES;SFEEW MODE	S	260005116	01011 000000000 0101001001110	J8538
8186	3KHZ GATE=PFIX;LO EN.=YES;SFPFIX MODE	S	260005117	01011 000000000 0101001001111	J8538
8187	3KHZ GATE=____;LO EN.=NO;NORMAL MODE	S	260005120	01011 000000000 0101001010000	J8538
8188	3KHZ GATE=____;LO EN.=NO;FAST ION MODE	S	260005121	01011 000000000 0101001010001	J8538
8189	3KHZ GATE=____;LO EN.=NO;FAST MIX MODE	S	260005122	01011 000000000 0101001010010	J8538
8190	3KHZ GATE=____;LO EN.=NO;SFPNS MODE	S	260005123	01011 000000000 0101001010011	J8538
8191	3KHZ GATE=____;LO EN.=NO;SFENS MODE	S	260005124	01011 000000000 0101001010100	J8538
8192	3KHZ GATE=____;LO EN.=NO;SFPEW MODE	S	260005125	01011 000000000 0101001010101	J8538
8193	3KHZ GATE=____;LO EN.=NO;SFEEW MODE	S	260005126	01011 000000000 0101001010110	J8538
8194	3KHZ GATE=____;LO EN.=NO;SFPFIX MODE	S	260005127	01011 000000000 0101001010111	J8538
8195	3KHZ GATE=____;LO EN.=YES;NORMAL MODE	S	260005130	01011 000000000 0101001011000	J8538
8196	3KHZ GATE=____;LO EN.=YES;FAST ION MODE	S	260005131	01011 000000000 0101001011001	J8538
8197	3KHZ GATE=____;LO EN.=YES;FAST MIX MODE	S	260005132	01011 000000000 0101001011010	J8538
8198	3KHZ GATE=____;LO EN.=YES;SFPNS MODE	S	260005133	01011 000000000 0101001011011	J8538
8199	3KHZ GATE=____;LO EN.=YES;SFENS MODE	S	260005134	01011 000000000 0101001011100	J8538
8200	3KHZ GATE=____;LO EN.=YES;SFPEW MODE	S	260005135	01011 000000000 0101001011101	J8538
8201	3KHZ GATE=____;LO EN.=YES;SFEEW MODE	S	260005136	01011 000000000 0101001011110	J8538
8202	3KHZ GATE=____;LO EN.=YES;SFPFIX MODE	S	260005137	01011 000000000 0101001011111	J8538
8203	3KHZ GATE=____;LO EN.=NO;NORMAL MODE	S	260005140	01011 000000000 0101001100000	J8538
8204	3KHZ GATE=____;LO EN.=NO;FAST ION MODE	S	260005141	01011 000000000 0101001100001	J8538
8205	3KHZ GATE=____;LO EN.=NO;FAST MIX MODE	S	260005142	01011 000000000 0101001100010	J8538
8206	3KHZ GATE=____;LO EN.=NO;SFPNS MODE	S	260005143	01011 000000000 0101001100011	J8538
8207	3KHZ GATE=____;LO EN.=NO;SFENS MODE	S	260005144	01011 000000000 0101001100100	J8538
8208	3KHZ GATE=____;LO EN.=NO;SFPEW MODE	S	260005145	01011 000000000 0101001100101	J8538
8209	3KHZ GATE=____;LO EN.=NO;SFEEW MODE	S	260005146	01011 000000000 0101001100110	J8538
8210	3KHZ GATE=____;LO EN.=NO;SFPFIX MODE	S	260005147	01011 000000000 0101001100111	J8538
8211	3KHZ GATE=____;LO EN.=YES;NORMAL MODE	S	260005150	01011 000000000 0101001101000	J8538
8212	3KHZ GATE=____;LO EN.=YES;FAST ION MODE	S	260005151	01011 000000000 0101001101001	J8538
8213	3KHZ GATE=____;LO EN.=YES;FAST MIX MODE	S	260005152	01011 000000000 0101001101010	J8538
8214	3KHZ GATE=____;LO EN.=YES;SFPNS MODE	S	260005153	01011 000000000 0101001101011	J8538
8215	3KHZ GATE=____;LO EN.=YES;SFENS MODE	S	260005154	01011 000000000 0101001101100	J8538
8216	3KHZ GATE=____;LO EN.=YES;SFPEW MODE	S	260005155	01011 000000000 0101001101101	J8538
8217	3KHZ GATE=____;LO EN.=YES;SFEEW MODE	S	260005156	01011 000000000 0101001101110	J8538
8218	3KHZ GATE=____;LO EN.=YES;SFPFIX MODE	S	260005157	01011 000000000 0101001101111	J8538
8219	3KHZ GATE=____;LO EN.=NO;NORMAL MODE	S	260005160	01011 000000000 0101001110000	J8538
8220	3KHZ GATE=____;LO EN.=NO;FAST ION MODE	S	260005161	01011 000000000 0101001110001	J8538
8221	3KHZ GATE=____;LO EN.=NO;FAST MIX MODE	S	260005162	01011 000000000 0101001110010	J8538
8222	3KHZ GATE=____;LO EN.=NO;SFPNS MODE	S	260005163	01011 000000000 0101001110011	J8538
8223	3KHZ GATE=____;LO EN.=NO;SFENS MODE	S	260005164	01011 000000000 0101001110100	J8538
8224	3KHZ GATE=____;LO EN.=NO;SFPEW MODE	S	260005165	01011 000000000 0101001110101	J8538
8225	3KHZ GATE=____;LO EN.=NO;SFEEW MODE	S	260005166	01011 000000000 0101001110110	J8538
8226	3KHZ GATE=____;LO EN.=NO;SFPFIX MODE	S	260005167	01011 000000000 0101001110111	J8538
8227	3KHZ GATE=____;LO EN.=YES;NORMAL MODE	S	260005170	01011 000000000 0101001111000	J8538
8228	3KHZ GATE=____;LO EN.=YES;FAST ION MODE	S	260005171	01011 000000000 0101001111001	J8538

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P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT ********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	8229	3KHZ GATE=____;LO EN.=YES;FAST MIX MODE	S	260005172	01011	000000000	0101001111010	J8538
	8230	3KHZ GATE=____;LO EN.=YES;SFPNS MODE	S	260005173	01011	000000000	0101001111011	J8538
	8231	3KHZ GATE=____;LO EN.=YES;SFENS MODE	S	260005174	01011	000000000	0101001111100	J8538
	8232	3KHZ GATE=____;LO EN.=YES;SFPEW MODE	S	260005175	01011	000000000	0101001111101	J8538
	8233	3KHZ GATE=____;LO EN.=YES;SFEEW MODE	S	260005176	01011	000000000	0101001111110	J8538
	8234	3KHZ GATE=____;LO EN.=YES;SFPFIX MODE	S	260005177	01011	000000000	0101001111111	J8538
	8235	3K MODE=AUTO;MOTOR PWR: EW=OFF,NS=OFF	S	260005400	01011	000000000	0101100000000	J8539
	8236	3K MODE=AUTO;MOTOR PWR: EW=OFF,NS=78.1	S	260005401	01011	000000000	0101100000001	J8539
	8237	3K MODE=AUTO;MOTOR PWR: EW=OFF,NS=62.5	S	260005402	01011	000000000	0101100000010	J8539
	8238	3K MODE=AUTO;MOTOR PWR: EW=OFF,NS=125	S	260005403	01011	000000000	0101100000011	J8539
	8239	3K MODE=AUTO;MOTOR PWR: EW=78.1,NS=OFF	S	260005410	01011	000000000	0101100001000	J8539
	8240	3K MODE=AUTO;MOTOR PWR: EW=78.1,NS=78.1	S	260005411	01011	000000000	0101100001001	J8539
	8241	3K MODE=AUTO;MOTOR PWR: EW=78.1,NS=62.5	S	260005412	01011	000000000	0101100001010	J8539
	8242	3K MODE=AUTO;MOTOR PWR: EW=78.1,NS=125	S	260005413	01011	000000000	0101100001011	J8539
	8243	3K MODE=AUTO;MOTOR PWR: EW=62.5,NS=OFF	S	260005420	01011	000000000	0101100010000	J8539
	8244	3K MODE=AUTO;MOTOR PWR: EW=62.5,NS=78.1	S	260005421	01011	000000000	0101100010001	J8539
	8245	3K MODE=AUTO;MOTOR PWR: EW=62.5,NS=62.5	S	260005422	01011	000000000	0101100010010	J8539
	8246	3K MODE=AUTO;MOTOR PWR: EW=62.5,NS=125	S	260005423	01011	000000000	0101100010011	J8539
	8247	3K MODE=AUTO;MOTOR PWR: EW=117,NS=OFF	S	260005430	01011	000000000	0101100011000	J8539
	8248	3K MODE=AUTO;MOTOR PWR: EW=117,NS=78.1	S	260005431	01011	000000000	0101100011001	J8539
	8249	3K MODE=AUTO;MOTOR PWR: EW=117,NS=62.5	S	260005432	01011	000000000	0101100011010	J8539
	8250	3K MODE=AUTO;MOTOR PWR: EW=117,NS=125	S	260005433	01011	000000000	0101100011011	J8539
	8251	3K MODE=LOW;MOTOR PWR: EW=OFF,NS=OFF	S	260005500	01011	000000000	0101101000000	J8539
	8252	3K MODE=LOW;MOTOR PWR: EW=OFF,NS=78.1	S	260005501	01011	000000000	0101101000001	J8539
	8253	3K MODE=LOW;MOTOR PWR: EW=OFF,NS=62.5	S	260005502	01011	000000000	0101101000010	J8539
	8254	3K MODE=LOW;MOTOR PWR: EW=OFF,NS=125	S	260005503	01011	000000000	0101101000011	J8539
	8255	3K MODE=LOW;MOTOR PWR: EW=78.1,NS=OFF	S	260005510	01011	000000000	0101101001000	J8539
	8256	3K MODE=LOW;MOTOR PWR: EW=78.1,NS=78.1	S	260005511	01011	000000000	0101101001001	J8539
	8257	3K MODE=LOW;MOTOR PWR: EW=78.1,NS=62.5	S	260005512	01011	000000000	0101101001010	J8539
	8258	3K MODE=LOW;MOTOR PWR: EW=78.1,NS=125	S	260005513	01011	000000000	0101101001011	J8539
	8259	3K MODE=LOW;MOTOR PWR: EW=62.5,NS=OFF	S	260005520	01011	000000000	0101101010000	J8539
	8260	3K MODE=LOW;MOTOR PWR: EW=62.5,NS=78.1	S	260005521	01011	000000000	0101101010001	J8539
	8261	3K MODE=LOW;MOTOR PWR: EW=62.5,NS=62.5	S	260005522	01011	000000000	0101101010010	J8539
	8262	3K MODE=LOW;MOTOR PWR: EW=62.5,NS=125	S	260005523	01011	000000000	0101101010011	J8539
	8263	3K MODE=LOW;MOTOR PWR: EW=117,NS=OFF	S	260005530	01011	000000000	0101101011000	J8539
	8264	3K MODE=LOW;MOTOR PWR: EW=117,NS=78.1	S	260005531	01011	000000000	0101101011001	J8539
	8265	3K MODE=LOW;MOTOR PWR: EW=117,NS=62.5	S	260005532	01011	000000000	0101101011010	J8539
	8266	3K MODE=LOW;MOTOR PWR: EW=117,NS=125	S	260005533	01011	000000000	0101101011011	J8539
	8267	3K MODE=HIGH;MOTOR PWR: EW=OFF,NS=OFF	S	260005600	01011	000000000	0101110000000	J8539
	8268	3K MODE=HIGH;MOTOR PWR: EW=OFF,NS=78.1	S	260005601	01011	000000000	0101110000001	J8539
	8269	3K MODE=HIGH;MOTOR PWR: EW=OFF,NS=62.5	S	260005602	01011	000000000	0101110000010	J8539
	8270	3K MODE=HIGH;MOTOR PWR: EW=OFF,NS=125	S	260005603	01011	000000000	0101110000011	J8539
	8271	3K MODE=HIGH;MOTOR PWR: EW=78.1,NS=OFF	S	260005610	01011	000000000	0101110001000	J8539
	8272	3K MODE=HIGH;MOTOR PWR: EW=78.1,NS=78.1	S	260005611	01011	000000000	0101110001001	J8539
	8273	3K MODE=HIGH;MOTOR PWR: EW=78.1,NS=62.5	S	260005612	01011	000000000	0101110001010	J8539
	8274	3K MODE=HIGH;MOTOR PWR: EW=78.1,NS=125	S	260005613	01011	000000000	0101110001011	J8539
	8275	3K MODE=HIGH;MOTOR PWR: EW=62.5,NS=OFF	S	260005620	01011	000000000	0101110010000	J8539
	8276	3K MODE=HIGH;MOTOR PWR: EW=62.5,NS=78.1	S	260005621	01011	000000000	0101110010001	J8539
	8277	3K MODE=HIGH;MOTOR PWR: EW=62.5,NS=62.5	S	260005622	01011	000000000	0101110010010	J8539
	8278	3K MODE=HIGH;MOTOR PWR: EW=62.5,NS=125	S	260005623	01011	000000000	0101110010011	J8539

A-102

P78-2 COMMAND LIST 08-18-78 REV ? STATE = (PULSE(P),LATCHING(L),UNLATCHING(U),MOMENTARY(M),SERIAL(S),NON-REDUNDANT RELAY(#))
SC9 EXPERIMENT *********** TEST LIST : NO PARITY **********

S	CMD NO.	NAME	STATE	OCTAL	BINARY BITS 6-32			TM VERIFICATION AND REFERENCE
	8279	3K MODE=HIGH;MOTOR PWR: EW=117,NS=OFF	S	260005630	01011	000000000	0101110011000	J8539
	8280	3K MODE=HIGH;MOTOR PWR: EW=117,NS=78.1	S	260005631	01011	000000000	0101110011001	J8539
	8281	3K MODE=HIGH;MOTOR PWR: EW=117,NS=62.5	S	260005632	01011	000000000	0101110011010	J8539
	8282	3K MODE=HIGH;MOTOR PWR: EW=117,NS=125	S	260005633	01011	000000000	0101110011011	J8539
	8283	NORTH SOUTH POSITION STATUS, 255	S	260002377	01011	000000000	0010011111111	J4014,J4017
	8284	EAST WEST POSITION STATUS, 255	S	260002777	01011	000000000	0010111111111	J4015,J4018
	8285	DWELL/CYCLE = 255	S	260003777	01011	000000000	0011111111111	J8533
	8286	INITIAL DWELL STEP = 255	S	260004377	01011	000000000	0100011111111	J8534
	8287	DWELL STEP SIZE = 0	S	260004400	01011	000000000	0100100000000	J8535
	8288	DWELL STEP SIZE = 255	S	260004777	01011	000000000	0100111111111	J8535
	8289	ACCUMULATOR GATING = 255	S	260005377	01011	000000000	0101011111111	J8538
	8290	MOTOR POWER = 255	S	260005777	01011	000000000	0101111111111	J8539
	8291	LEHLEI-DSS 0	S	260004500	01011	000000000	0100101000000	J8535 LC 124-42
	8292	LEHLEI-DSS 1	S	260004501	01011	000000000	0100101000001	J8535 LC 124-42
	8293	LEHLEI-DSS 2	S	260004502	01011	000000000	0100101000010	J8535 LC 124-42
	8294	LEHLEI-DSS 4	S	260004504	01011	000000000	0100101000100	J8535 LC 124-42
	8295	LEHLEI-DSS 8	S	260004510	01011	000000000	0100101001000	J8535 LC 124-42
	8296	LEHLEI-DSS 16	S	260004520	01011	000000000	0100101010000	J8535 LC 124-42
	8297	LEHLEI-DSS 32	S	260004540	01011	000000000	0100101100000	J8535 LC 124-42

APPENDIX 8

STATUS WORD MAP

SC-7 STATUS DATA STRUCTURE
WORD 106

MFRAME	MSB 2**7	2**6	2**5	2**4	2**3	2**2	2**1	LSB 2**0
0	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
1	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
2	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
3	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
4	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
5	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
6	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
7	B8NSLL	B7NSLL	B6NSLL	B5NSLL	B4NSLL	B3NSLL	B2NSLL	B1NSLL
8	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
9	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
10	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
11	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
12	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
13	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
14	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
15	B8NSUL	B7NSUL	B6NSUL	B5NSUL	B4NSUL	B3NSUL	B2NSUL	B1NSUL
16	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
17	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
18	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
19	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
20	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
21	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
22	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
23	B8EWLL	B7EWLL	B6EWLL	B5EWLL	B4EWLL	B3EWLL	B2EWLL	B1EWLL
24	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
25	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
26	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
27	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
28	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
29	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
30	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
31	B8EWUL	B7EWUL	B6EWUL	B5EWUL	B4EWUL	B3EWUL	B2EWUL	B1EWUL
32	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
33	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
34	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
35	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
36	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
37	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
38	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
39	NBE	NS WAG	NSSWEEP	NS200	NSP180	-NSP90	NSP0	NSP-20
40	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
41	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
42	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
43	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
44	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
45	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
46	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
47	EWE	EW WAG	EWSWEEP	EWP200	EWP180	-EWP90	EWP0	EWP-20
48	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
49	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
50	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
51	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
52	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
53	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
54	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
55	SCHONLY	OFLOBEL	J6DTC	J5DTC	J4DTC	J3DTC	J2DTC	J1DTC
56	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
57	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
58	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
59	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
60	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
61	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
62	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
63	**TBD**	**TBD**	**TBD**	J5DNC	J4DNC	J3DNC	J2DNC	J1DNC

SC-7 STATUS DATA STRUCTURE
WORD 106

MFRAME	MSB 2**7	2**6	2**5	2**4	2**3	2**2	2**1	LSB 2**0
64	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
65	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
66	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
67	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
68	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
69	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
70	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
71	**TBD**	**TBD**	J6DSC	J5DSC	J4DSC	J3DSC	J2DSC	J1DSC
72	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
73	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
74	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
75	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
76	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
77	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
78	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
79	**TBD**	**TBD**	T6DSC	T5DSC	T4DSC	T3DSC	T2DSC	T1DSC
80	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
81	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
82	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
83	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
84	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
85	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
86	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
87	**TBD**	**TBD**	**TBD**	**TBD**	LEN	AG2	AG1	AG0
88	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
89	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
90	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
91	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
92	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
93	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
94	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
95	**TBD**	**TBD**	EW OFF	EW62.5	EWC0	NS OFF	NS62.5	NSB0
96	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
97	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
98	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
99	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
100	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
101	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
102	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
103	**TBD**	LC7B	LC6B	LC5B	LC4B	LC3B	LC2B	LC1B
104	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
105	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
106	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
107	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
108	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
109	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
110	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
111	**TBD**	LC14B	LC13B	LC12B	LC11B	LC10B	LC9B	LC8B
112	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
113	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
114	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
115	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
116	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
117	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
118	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
119	CBUS8	CBUS7	CBUS6	CBUS5	CBUS4	CBUS3	CBUS2	CBUS1
120	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
121	NSPB8	NSPB7	NSPB6	NSPB5	NSPB4	NSPB3	NSPB2	NSPB1
122	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
123	EWPB8	EWPB7	EWPB6	EWPB5	EWPB4	EWPB3	EWPB2	EWPB1
124	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
125	CCWEW	EWPB11	EWPB10	EWPB9	CCWNS	NSPB11	NSPB10	NSPB9
126	**TBD**	SCAN	B6DCC	B5DCC	B4DCC	B3DCC	B2DCC	B1DCC
127	PARITY	PCE	FE	0	NC12	NC11	NC10	NC9

APPENDIX 9

Calibration of Experiment SC9 on Satellite P78-2

This document describes the current state of the calibration as of 28 February 1981 of experiment SC-9 on satellite P78-2.

1. IONS

Both the ion and electron guns use multichannel differential electrostatic analyzers. We have been using the geometric factor (G) and conversion factor (H) from ATS-6;

G = 1.6*10**-3 cm-cm-sterad

H = G * (delta E)/E = 0.2*G

An energy dependent efficiency is added to this conversion factor at low energies due to the post-analysis acceleration of particles between the focussing lens and the spiraltron detector to give the complete conversion factor. This occurs gradually around 1-3 keV for the ions (fig. 1.1). The efficiency variations are described by

eff(ions) = 1 + 2/[1 + (E(keV)/1.5)**3]

and the corrected count rate is (raw count rate)/eff(ion).

Data was compared between SC-2,SC-5 and SC-9 to test for agreement. The ion data appeared to agree well over the entire range of overlapping energies (fig. 1.2, 1.3).

2. Energy Corrections

In the high energy (North/South) detectors the actual voltage on the analyzer plates differs from the nominal voltage

E0 = -21 + 16.1*(1.145**S)

where S is the step number (0<=S<=63). One must take into account a temperature dependent transient response voltage which occurs following the transition from a high energy step to a low energy step. When the analyzer voltage drops from a high value to a low value a voltage offset occurs. This offset is unpredictable for the first 1/4 to 1/2 second and then decays away with a 1/(t+c) response, where t is the time after the transition. In order to compensate for this effect we must add a temperature dependent correction term to E0.

E = E0 +C1*[1/(4t+1) + 1/[4*(dwell time) + 65] -1/97]

where C1 has the form

C1 = A + B*exp(C*T)

The constants A,B and C were determined using the high energy electron data. During a very low energy dwell the analyzer energy will sweep through the photoelectron spike and a C1 value can be chosen to fit the dwell spectrum to the scan spectrum which follows it. The fit was done for temperatures of 8,13 and 17 degrees centigrade, and the values were determined to be

A = 18.3 B = 0.43 C = 0.06

More work to determine these values more precisely would be desirable, and probably will be undertaken as software development permits.

3. Analog Voltage Determination of Detector Angles

There are two methods of determining the position of the rotating de-

tector assemblies, a digital step counter and an analog voltage. The step counter is normally more accurate, but when the detector sticks the voltage must be used to determine the detector angle.

We looked for days when the heads were rotating without sticking at various temperatures in order to cross-calibrate these two methods. We plotted voltage against Angle(step counter) (see fig 3.1), assuming a standard curve at 21 degrees (fig 3.2). A straight-line-segment fit was made to this curve. The assumption was made that the temperature shifted the standard curve linearly, proportional to the voltage.

A hysteresis problem is apparent in figure 3.1, for the voltage as the detector moves up is not the same as the voltage at the same position as it swings back the other way. This is at present unexplained. The effect is small enough to allow us to use the piecewise-linear fit we have obtained and yet is annoying enough to merit some future consideration.

4. Electrons

The analysis for electrons is similar to that for ions. The geometric factor has been halved by placing a plate over the detector aperture to prolong the useful life of the spiraltron. This is necessary because the electron sensors are subject to much higher counting rates than are the ion sensors. The expression for lens efficiency is

$$\begin{gathered} \text{eff} = A/C \\ C = 1 \quad ; E < 100 \text{ eV} \\ C = 1 + 50/E(\text{eV}) \quad ; E > 100 \text{ eV} \\ A = 1 + 2/[1 + (E(\text{keV})/.15)^{**}3] \end{gathered}$$

C takes into account the fact that the suppressor voltage is turned on at 100 eV to exclude secondary electrons and other background producing particles.

The electron detectors must also take into account the spiraltron efficiency. We use the calibration curve of Archuleta and DeForest (1971) that was obtained for the instrument that flew on ATS-5. They found that the efficiency was approximately constant for ions, and for electrons the following was a good fit to the data.

$$\begin{gathered} \text{eff(spi)} = 1 - 2/B \\ B = 3 + 6.5\,[.2 + E(\text{keV})] + 30/[.2 + E(\text{keV})]^{**}3 \end{gathered}$$

The total conversion factor as a function of energy is shown in figure 1.1. The corrected count rate is given by

$$\text{CR(corrected)} = \text{CR(raw)}/[\text{eff(spi)}^*\text{eff(lens)}]$$

Comparison of our data with that of other instruments in the same energy range reveals that when comparing distribution functions we were higher by factors on the order of 5 to 10 (figures 1.2, 4.1). The high count rates seem to indicate that these are real discrepencies that can't be explained as fluctuations. It is necessary to look at all three instruments and examine the possible causes for these differences.

a) spiraltron degradation

Several of the bias tests that had been run were analyzed to try to get a handle on the problem of spiraltron degradation. The detecters have four allowable bias levels. They allow us to vary the voltage applied across the spiraltrons and so vary their sensitivity.

A bias test is designed to run through a series of bias levels in a constant envioroment, allowing us to determine if an increased bias level results in an increased counting rate. If not, all the particles are being measured. If so, the instrument is degraded somewhat, and we can normalize our counts to the highest bias level.

Usable bias tests were run on days 39,179,201 and 278. Scans were plotted for each bias level and the spectral shift was estimated. More work needs to be done in this area. Cross-calibration with the other instruments will allow us to make the bias data absolute, rather than merely relative to our highest bias level. Also ,long-term averaging of electron count rates could be done to show us the overall fall off in spiraltron sensitivity.

b) spiraltron calibration

Hardy claims to have obtained a significantly different calibration curve than that of Archuletes and DeForest while calibrating his instrument. The possibility exists that our spiraltron calibration curve might be wrong. Perhaps mutual normalization of SC-2, SC-5 and SC-9 is the way to approach this; we could get numbers that we could agree on even if they were not correct in the absolute sense.

c) geometric factors

It is desirable to verify that the geometric factor that we are using is correct. One method of doing this is to search our data set for cases where the spacecraft charges after becoming eclipsed. If we assume that the enviroment is constant, we will see the same spectrum shifted in energy. If we can find these situations it will allow us to compare our calibration at different energies and so verify our geometric factor.

5. Sun Pulses

The problem of sun pulses should also be addressed. Our instrument gives us high count rates when pointing in the direction of the sun. Figure 5.1 shows this effect. The stars represent data taken while our instrument is looking at the hemisphere towards the sun, the circles that data taken while the instrument was pointing away from the sun. The added counts due to the sun can be seen in the angle dependent deviation from the actual spectrum defined by the circles in the data taken while we were pointing towards the sun.

We need to extend our software to extract the sun angle from the attitude information. We can then look through a statistically significant number of cases to determine the response of our detector as a

function of sun angle. If this is constant over time we could then subtract out the "average sun response" from our data as appropriate.

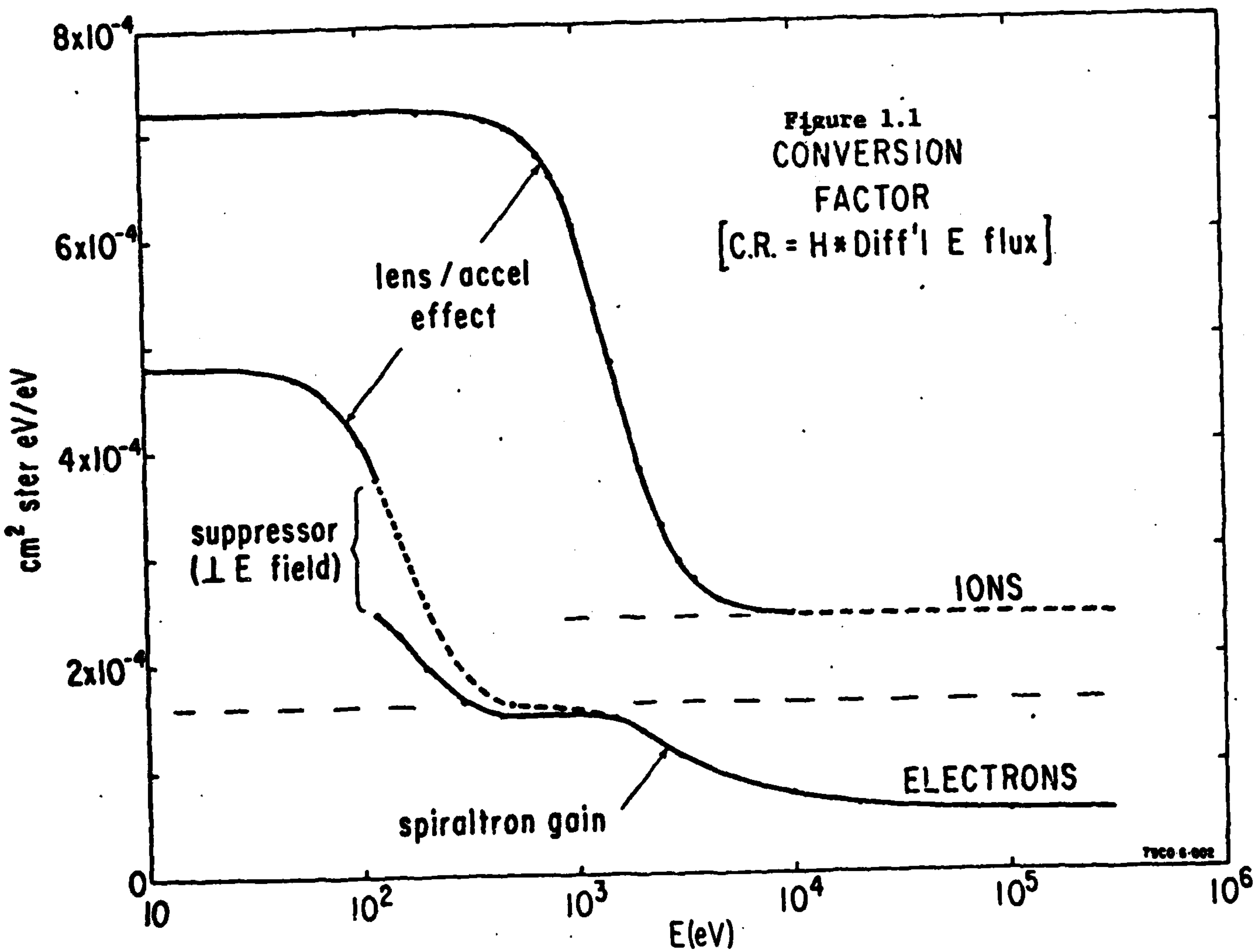

Figure 1.1
CONVERSION FACTOR
[C.R. = H * Diff'l E flux]

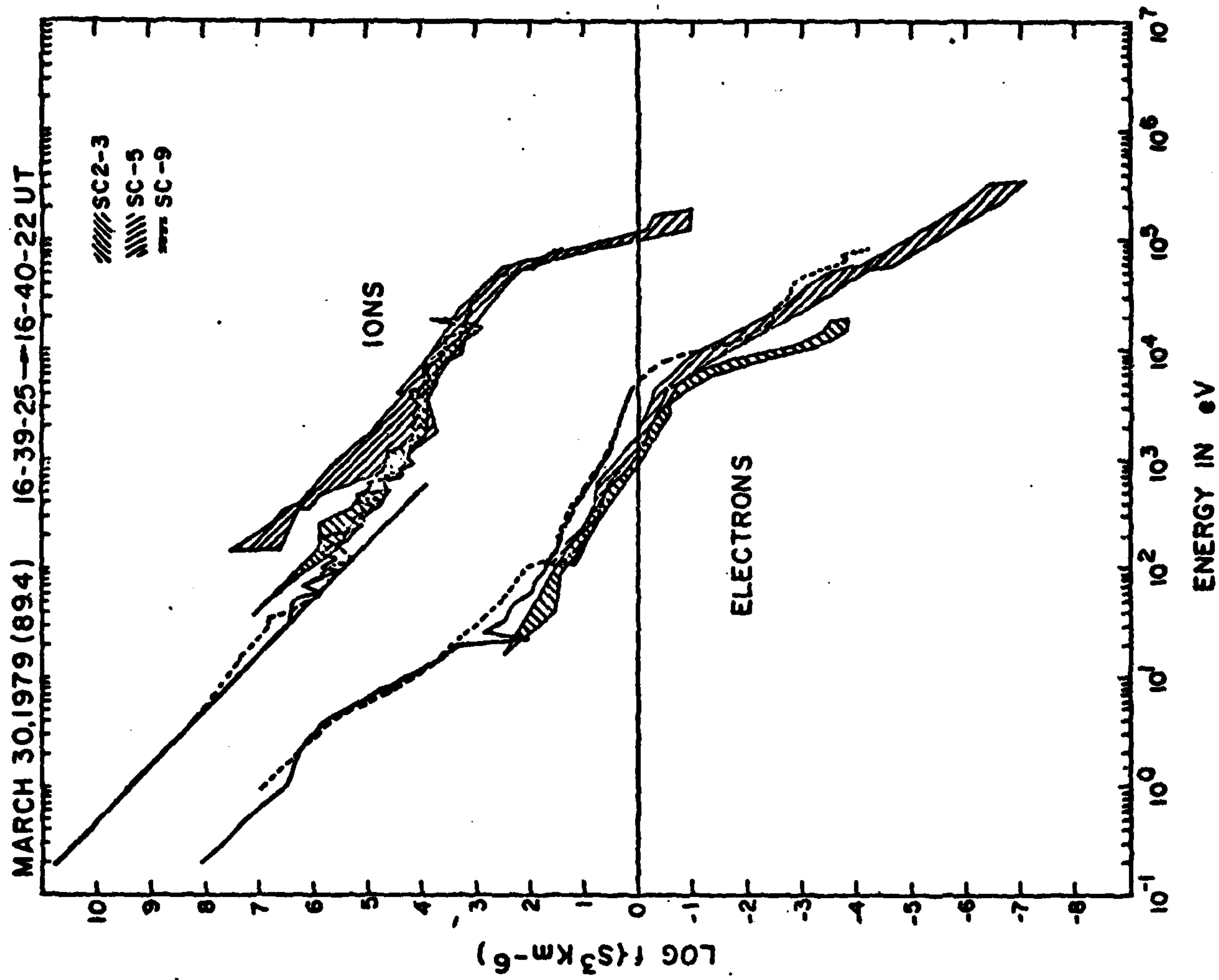

Fig. 1.2 from a comparison of SC2-3, Sc-5 and SC-9
Prepared by M. S. Gussenhoven

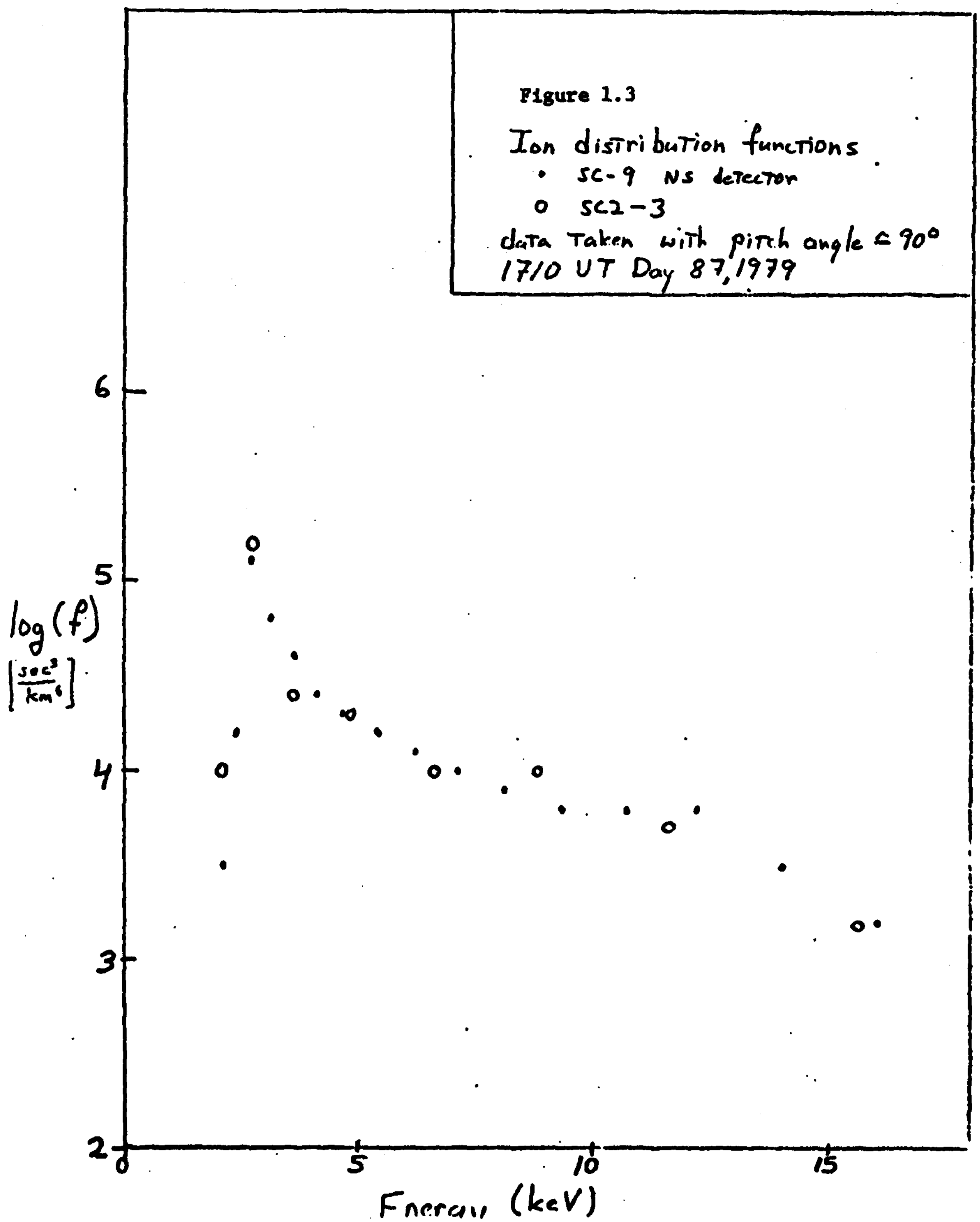

Figure 1.3

Ion distribution functions

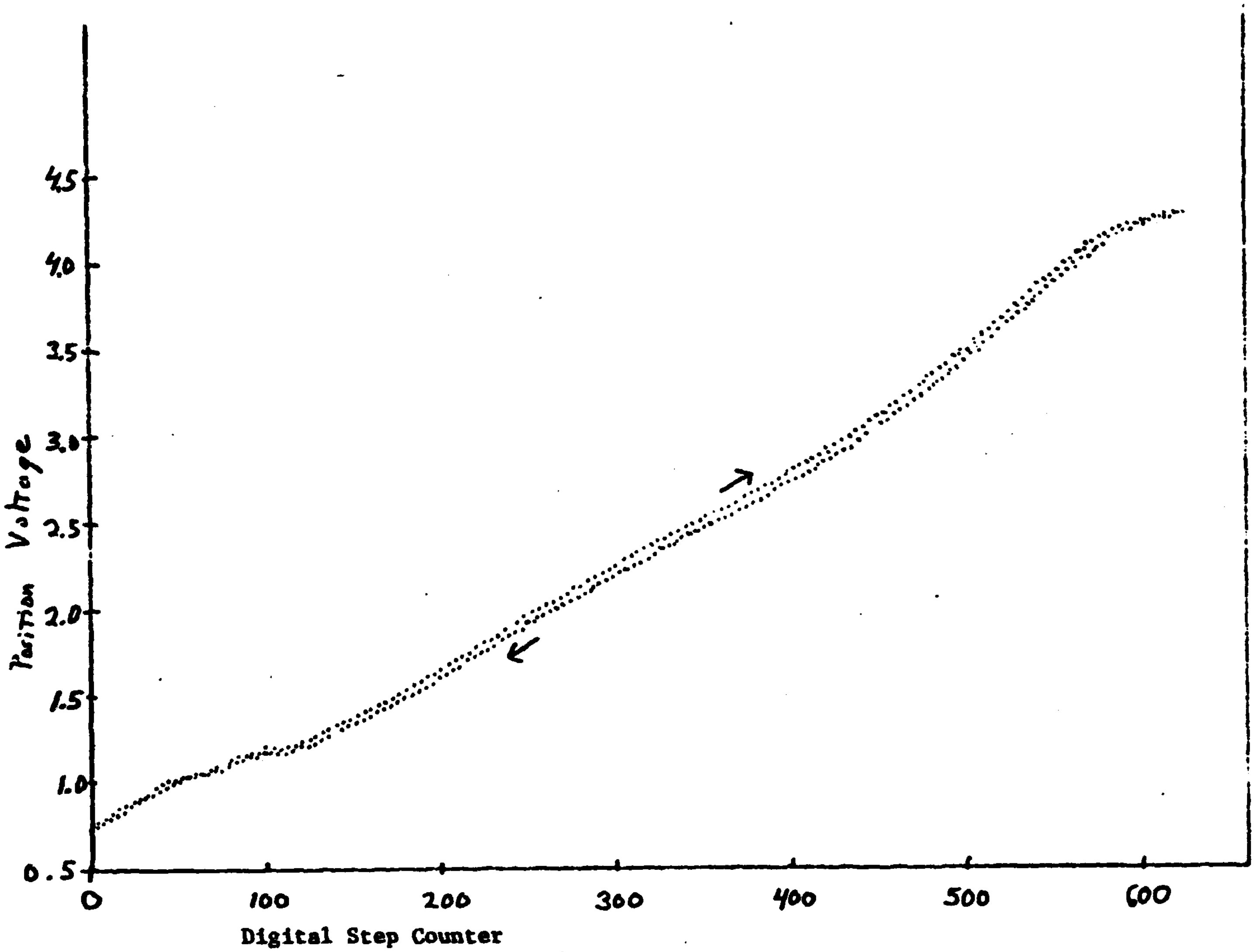

Figure 3.1 Correlation between Analog and digital methods of detector angle determination

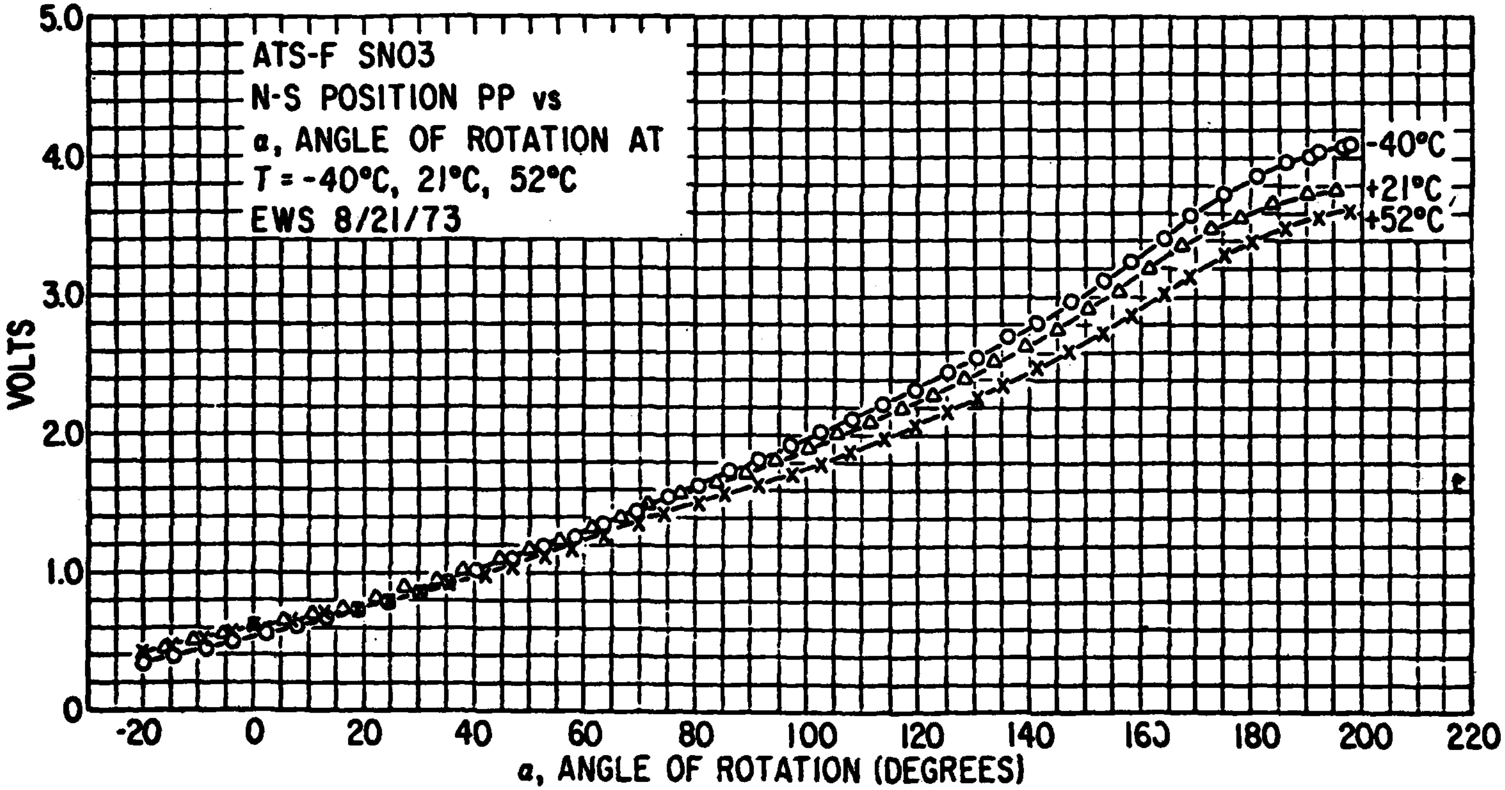
ATS-F SNO3
N-S POSITION PP vs
a, ANGLE OF ROTATION AT
T = -40°C, 21°C, 52°C
EWS 8/21/73
-40°C
+21°C
+52°C
VOLTS
5.0
4.0
3.0
2.0
1.0
0
-20
0
20
40
60
80
100
120
140
160
180
200
220
a, ANGLE OF ROTATION (DEGREES)

Figure 3.2

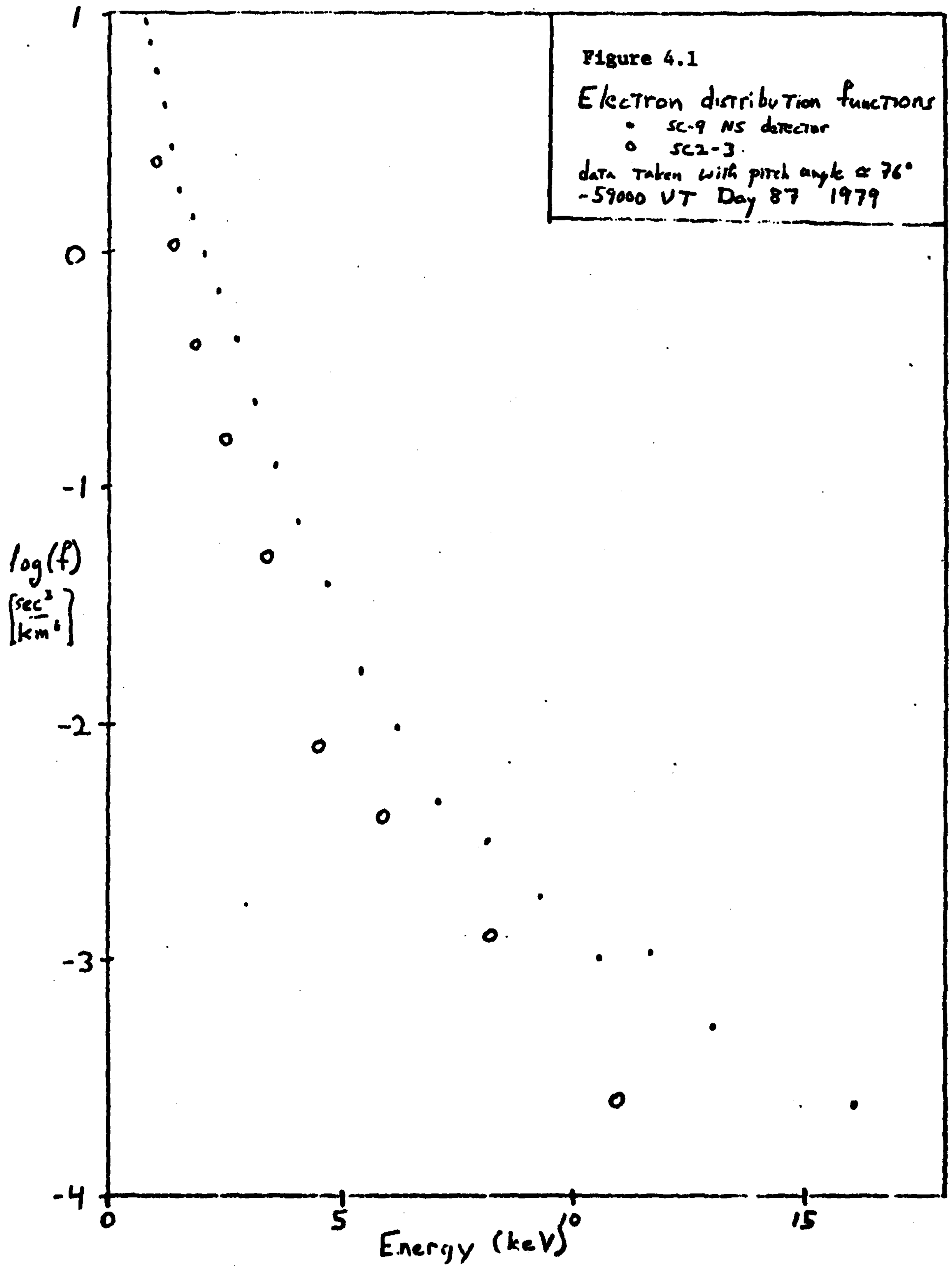
Figure 4.1
Electron distribution functions
• SC-9 NS detector
o SC2-3
data Taken with pitch angle ≈ 76°
-59000 UT Day 87 1979
log(f)
[sec³/km⁶]
1
0
-1
-2
-3
-4
0
5
10
15
Energy (keV)

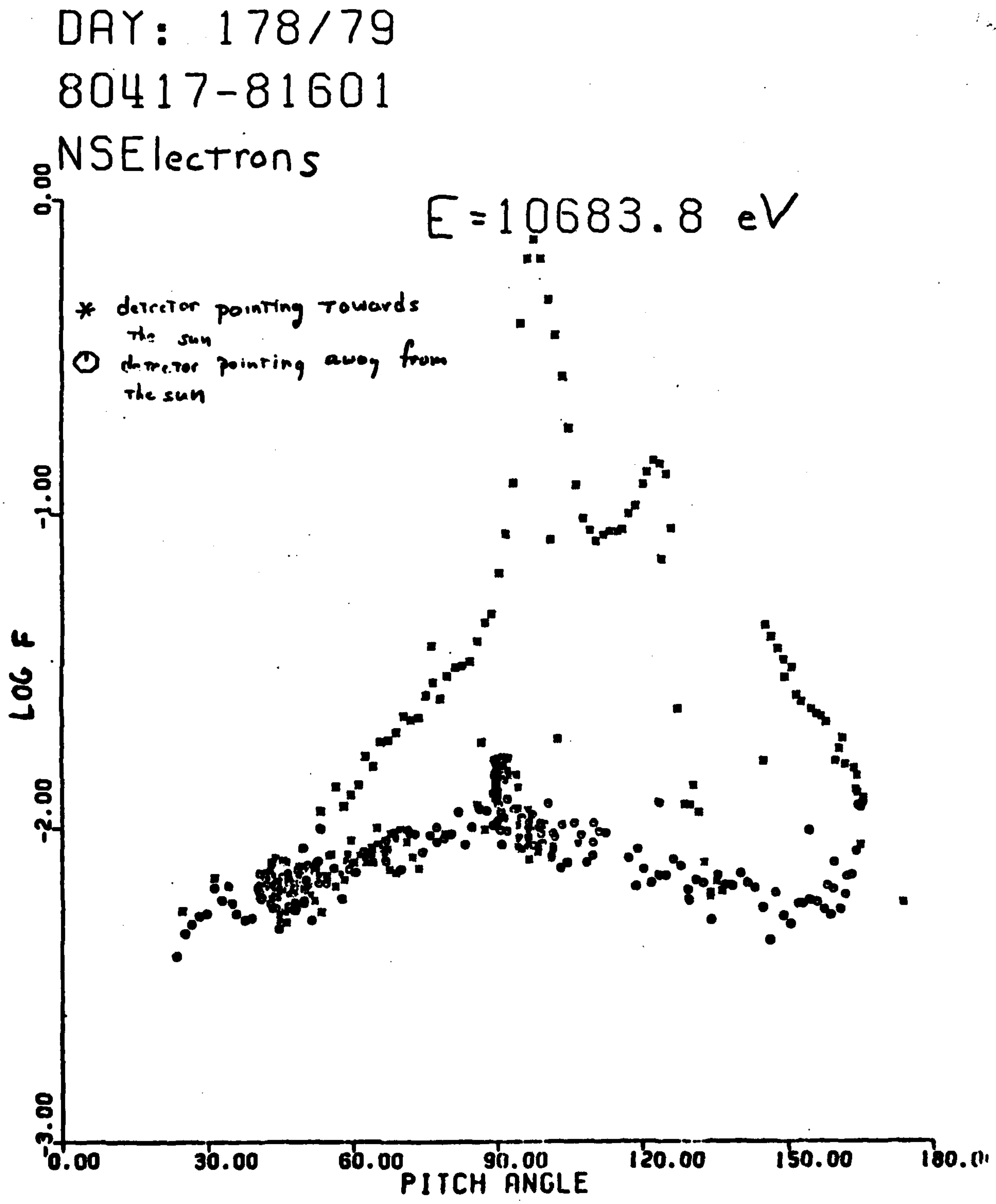

Figure 5.1 Sun Pulse Contaminated Spectrum